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Worldwide Report

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

No. 244

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ASIA

PAPER REPORTS, COMMENTS ON INSAT-1A FAILURE

National Television Affected

Calcutta THE STATESMAN in English 8 Sep 82 p 1

[Text] NEW DELHI, Sept. 7.—Doordarshan, which launched on August 15 an ambitious scheme for welding its various centres into a national network with the aid of INSAT-1A, seems to be the worst affected by the total collapse of that multi-purpose communications satellite on Saturday afternoon.

The 90-minute national programme, the principal element in that effort, can be telecast only to 10 centres which were even earlier joined together by microwave links, and cannot claim any more to be a truly national programme. At least one official said that the programme may have to be scrapped.

Eight relay stations—at Jaipur, Ahmedabad, Nagpur, Raipur, Muzaffarpur Sambalpur, Hyderabad and Gulbarga—which received transmissions through INSAT and had thus been linked with the other centres in the national network are out of it now with the collapse of the satellite (although they will be supplied canned programmes and kept going).

An effort is apparently being made to keep the network alive, possibly through microwave links. Doordarshan engineers had preliminary discussions today with telecommunications officials for that purpose.

At Doordarshan headquarters, its Director-General, Mr Shailendra Shankar, said: "The picture is not yet clear; we shall know in two or three days".

The other major, and sadder, casualty is the educational service devised by the National Council of Education Research and Training and telecast, in the first instance for 45 minutes each by the Hyderabad and Sambalpur centres for selected clusters of villages since mid-August.

The NCERT is understood to have devised over 50 special programmes for this purpose. On the basis of viewers' reaction, the programmes were to have been revisited for use when INSAT-1B, the second such satellite, was shot into space next July. After what has happened now, the outlook for that entire educational telecast experiment seems uncertain.

Half-hour development programmes telecast in the evening for Andhra and Orissa villages since August 15 have ended. With the satellite fading out on Saturday afternoon, the programmes telecast the previous evening were the last, as of now.

Similar educational telecasts and "area-effective" developmental ones were scheduled to be started in 1984-85 with the aid of INSAT in Bihar, Gujarat, Maharashtra and Uttar Pradesh. Whether the authorities will go ahead to create the infrastructure for such telecasts is an open question.

One other prestigious proposal was for utilization of the satellite for extension of TV coverage of ASIAD-82 to some 20 locations in the country, including the north-east region and States where at present there is no TV service. Such an extension was to have been effected well before the start of ASIAD. Doordarshan's present consultations with the Communications Ministry seem to be aimed primarily at ensuring coverage for ASIAD at least through existing centres.

There was also a scheme for extension of regular TV coverage to the north-eastern region by names of INSAT's TV capability. That will have to wait until the next satellite is in position.

Will colour telecasts, which were also initiated on August 15, be affected by the INSAT failure? The answer is, no, for colour telecasts have little to do with INSAT.

What is the net loss to the country from the extinction of INSAT? Officials say the satellite was fully insured and that part of its cost (of over Rs 60 crores) could certainly be recovered. A further sum of Rs 240 crores had been invested in various other hardware and ground installations. These, the officials add will not be allowed to go to waste.

A high level experts team is likely to be constituted for working out a new strategy for satellite programmes following the premature end of INSAT-1A, add UNI and PTI.

The team, which may have representatives from user departments also will try to ascertain the exact causes of the failure of INSAT-1A so that necessary modifications can be carried out in INSAT-1B.

There is no agreement among the various departments on advancing the launch of INSAT-1B. Some feel that it would be unwise to advance the date before ascertaining the causes of the failure of INSAT-1A and carrying out the necessary modifications. The chances of advancing the launch are remote since INSAT-1B is booked for flight in the U.S. space shuttle. Any advancement would mean findng an alternative launch vehicle.

'Unsatisfactory' Handling of Project

Calcutta THE STATESMAN in English 8 Sep 82 p 8

[Editorial]

[Text] JUST when the stage was set for utilizing about 1,400 telecommunication circuits of the INSAT-1A by the end of the year, the satellite developed serious fresh trouble. And soon it was declared dead. Its expected life-span had earlier been reduced from seven years to two and a half because of persistent difficulties with the solar sail. In the event, it has been operational, and that too in a limited way, for less than a month. It became "quasi-operational" in June, two months after the launch, and was pressed into regular operation in the middle of August. Its troubles, in fact, had begun before the launch when the solar sail was found to be defective. Whether the substitute did not work because it was originally meant for the INSAT-1B or because it was not adequately tested is not clear. That such questions should arise is itself disquieting, particularly because any trouble with this component was expected to increase fuel consumption well beyond permissible levels and cause technical problems. This indeed seems to have happened; the satellite lost its "attitude orientation"; its contact with the ground began to be frequently disrupted; and it stopped sending cloud pictures. Earlier, it had lost fuel during manoeuvres to free a jammed antenna and to deploy the sail. Lately the antenna was giving trouble again and said to be "looking the other way". All this pointed to a nearly total failure, until the formal announcement of an inglorious end to the whole mission.

Apart from the huge financial loss, the technical setback will compel a fresh look at the unsatisfactory way the project has been handled. The American manufacturers have set up a "failure review board" and are conducting "special tests" to ensure that similar defects do not appear in INSAT-1B, scheduled to be launched in July next year. But responsibility for what went wrong with INSAT-1A needs first to be clearly fixed. The public cannot judge, since the exact nature of the contractual obligations has not been disclosed. If the U.S. agencies which were required under contract to manufacture and launch the satellite had failed in any respect, this needs to be unambiguously spelt out and taken into account in reviewing the INSAT-1B plan. However, judging by the hectic involvement of Indian space scientists immediately after the launch, U. S. responsibility may not have been quite so clearcut. Or was it a case of the Indian space organization getting into the act before strict-

ly necessary, perhaps hoping to claim part of the credit for what was expected to be a spectacular success? The extravagant enthusiasm displayed by Indian spokesmen both before and after the launch did not allow any hard-headed examination of such questions. But they have become extremely important after the project's failure. If it can be ascribed to defects or deficiencies in the American part of the job, there should be a reappraisal of the entire contract. If, however, trouble was caused by premature and unsure Indian intervention, this is an unmitigated disgrace. The satellite could not have developed such serious trouble so soon if it had been transferred to Indian control in a fully operational condition, as it should have been under a normal contract.

CSO: 5500/7240

SPACE ORGANIZATIONS CONSIDERS STANDBY FOR INSAT-1B

Madras THE HINDU in English 8 Sep 82 p 9

[Text] BANGALORE, Sept. 7.

The possibilities of having a stand-by satellite to Insat-1B satellite, scheduled to be launched in July 1983, are being considered by the Indian Space Research Organisation.

The stand-by satellite is being thought of to meet any contingency like the one created by Insat-1A which was dogged by snags from the time of its launching and finally became unoperational.

Discussions are also taking place on the snags and constraints which rusulted in the premature turning-off of Insat-1A so that they could be overcome in Insat-1B, according to the Project Director, Mr. P. P. Kale.

PTI, UNI report:

Insat-1B was conceived originally as a stand-by to Insat-1A, which was planned to last for seven years. Now Insat-1B would become the main satellite and the process of the Insat programme will be restarted.

Mr. Kale told PTI that discussions were already on to find out if the stand-by satellite could be indigenously produced.

Dr. Kale, however ruled out the possibility of advancing the launch of Insat-1B, which was in an advanced stage of testing.

No chance of collision: Insat-1A, though dead, is likely to be in space for another 1,000 years, according to Mr. Kale.

The chances were "extremely remote," Mr. Kale said, when asked whether the satellite would not hit the neighbouring spacecraft.

The Skylab came down as it was only about 300 km above the earth unlike Insat-1A, which was on a geostationary orbit, about 36,000 km above the equator, he said.

The premature end of Insat-1A was caused by the failure of a valve on the oxidiser line, according to space officials.

Mr. Kale said that the isolation valve on the oxidiser line failed to open. This exhausted the fuel which was used up during the several commands sent to correct the altitude of the satellite on September 4.

The orientation of the satellite is altered by firing small thruster rockets which use the fuel (mono-methyl hydrazine) and an oxidiser (nitrogen tetroxide).

Valve jammed: Since the valve on the oxidiser line was jammed, the thruster rockets received only the fuel, but no oxidiser. At the same time, the repeated attempts to reorient the satellite exhausted the fuel.

Mr. Kale said there was no defect in the design of Insat-1A. The defect with the solar sail which failed to open up has now been rectified in Insat-1B.

Mr. Kale said the solar sail could not be deployed in Insat-1A owing to the low initial repulsive force.

Excess weight: Excess weight was a factor in the "premature death" of Insat-1A.

When the satellite was readied for its mission in February, it was found to weigh 20 kg more than the planned 1,150 kg.

Although this meant overuse of energy, the satellite was sent up without being divested of its extra weight.

This excess weight added to the strains the satellite had to endure in the series of manoeuvres.

Insat-1B is identical to Insat-1A in all respects except its launching, and was originally intended as an on orbital spare with certain major path telecommunications utilisation.

Insat-1B would be located at 94 degrees east longitude (east of Calcutta) in the geostationary orbit.

Launch by space shuttle: While the first satellite was launched by the two-stage Delta 3910 launcher of the U.S. National Aeronautics and Space Administration, the launch of Insat-1B will be by the U.S. space shuttle (the reusable manned launcher) on board its eighth flight.

Both are on a cost-reimbursible basis.

Ford Corpn. review: Meanwhile, the Ford Aerospace Corporation of the U.S., the manufacturers of Insat-1A, had constituted a failure review board. Tests for commanding the VHHR transmitters in various modes were also being carried out by the Master Control Facility. The power drop on August 13 in VHHR resulted in stoppage of transmission of cloud pictures for meteorological purposes by Insat-1A.

Insurance cover: The insurance money for the 'dead' Insat-1A is assured as it has been provided cover for the first 180 days in orbit.

CSO: 5500/7241

ITI 'LEAP' INTO ELECTRONIC TELECOM SYSTEMS DESCRIBED

Bombay THE TIMES OF INDIA in English 11 Sep 82 p 15

[Text]

PALGHAT:

FROM the fringes of the countryside to hinterland, there have been miles to go. But no more, since the indigenous research and development has covered the distance in one big leap with the introduction of faster communications medium. A dream seems to have come true.

A generation of the family of micro-processor-controlled rural auto electronic exchanges, designed, fabricated and field-tested have been found to function well in typical Indian rural conditions besides being economical to operate and easier to maintain. They will be now installed in hilly, tribal, backward, plain, desert areas to bring the rural regions near to the technologically advanced levels.

Needless to say that the telecom facility is crucial to rural development. Response to a single telephonic call for help could save a crop and be of use in many other ways. It will be worthwhile for Post and Telegraphs to initiate a cost-benefit study of rural telephones, now that a manufacturing programme for these exchanges has been launched.

Another 200-line micro-processor-controlled terminal exchange for use in the rural network will go for field trial shortly.

The Palghat unit of the Indian Telephone Industries, the authorities assert, possesses as many facilities as those of the best of its kind anywhere.

The rural auto exchanges are based on a system expandable from as low as eight lines to 200 lines. There is absolutely no intellectual input from abroad for the system. Its uptodate facilities, skilled manpower and ambitious expansion plans testify to this fact.

The general manager of the Palghat unit, Mr. R. Narayanan, said in addition to the nine exchanges already functioning in the field, 20 would roll out of the factory soon. Designs have been completed to assemble 100 more this year. The target is to produce 200 exchanges annually, Mr. Narayanan said.

Besides, the exchanges for villages, the small system is capable of turning out electronic private automatic exchanges, the electronic transit exchange and the electronic private automatic branch exchange (EPAX). Market studies point to a considerable demand for them other than from the P and T.

An interesting feature of this family is that sub-units will be inter-changeable. This means lower production cost because of the large volume. The maintenance cost is also low since staff training can be restricted to a few types of sub-systems, he said.

THE EPAX SYSTEM

The EPAX system which is already under production at Palghat is designed to meet the varying needs of users like large factories, hospitals and hotels apart from providing communication facility among extensions by dialling a three-digit number. These also provide for automatic transfer of incoming calls from one extension to another, interruption by a priority subscriber, three-way conversation, call forward (disconnection from the original subscriber), routing to the new subscriber and continuous operational supervision.

In spite of its rapid strides, it is idle to overlook the gap between the technology in use and the contemporary technology in advanced countries. Keeping this in view, the Palghat unit is waiting for a collaboration to fill the gap in a few specific areas of production technology for digital trunk automatic exchanges. The evaluation of global bids is expected to be complete in another four months.

In a technology where the rate of obsolescence is breathtakingly fast, there is little time to be lost. Fortunately, the ITI has the infrastructure for updating on product lines once the know-how is available.

This once again underlines the need for a much larger support for the R and D effort. Also, the quality of components has to prove the severest tests. Perhaps, the ITI has to put up with this constraint for some time. The Palghat unit is rather better placed in this direction, as it has some

of the latest generation testing equipment available nowhere else in the country.

The eight-year-old unit, situated in the Kerala version of Silicon Valley (with several electronic units emerging), has already recorded an output 23,000 lines of electronic switching equipment. It is all set for the third phase of its expansion that will take production capacity to 1,50,000 lines a year. Only the collaborator has to be announced.

Palghat, along with the two other proposed switching factories, will produce about 1.15 million lines by the end of the decade. Still, there might be a gap between supply and demand.

SEVERAL FIRSTS TO CREDIT

The Palghat product lines have a few firsts. Its semi-automatic guided assembly stations have capability to guide the operator to insert various electronic components into the printed circuit board at appropriate places, minimising efforts. These are being introduced on the production line for the first time.

Another first is the computer-controlled "bed-of-nails tester" which identifies faulty components and other assembly faults on a video screen or a printer in order to locate faults quickly.

A computer-controlled backplane wiring tester is also the first of its kind to be used on the production line. Here, the faults like missing, wrong and unwanted connections are indicated on a video screen.

In addition, several dedicated testers developed in-house at the ITI are also used on the production line for testing. The reliability of components used in the systems is increased by subjecting them to "burn-in" and thermal shock for which necessary equipment have been provided.

Still, its biggest achievement will be the provision of a reliable telephone to the countryside.

CSO: 5500/7245

WORK OF ITI IN TELEPHONE IMPROVEMENT TOLD

Bombay THE TIMES OF INDIA in English 7 Sep 82 p 20

[Text] NEW DELHI, September 6 (UNI)--THE Indian Telephone Industries Limited (ITI), which will shortly launch a project for the manufacture of a more reliable and cost-effective telephone instrument with foreign technical assistance, has started developing an all-electronic telephone.

The manufacture of the electronic telephone would be undertaken after comprehensive field trials for adaptation to the local network.

It would, however, take some more years for the ITI to introduce the electronic telephone, whch according to its chairman and managing director, Mr. C. S. S. Rao is yet to be perpected.

Talking to newsmen who visited the ITI factory in Bangalore, Mr. Rao said the ITI would not face any difficulty in manufacturing electronic telephones. The collaboration for the contemporary telephone would take care of electronic options also.

Mr. Rao expected the new project for manufacture of the contemporary telephone instrument to take off for production by January 1984. The project costing about Rs. 25 crores would produce one million instruments per annum besides parts and spares including transmitter, receiver and dials. The final clearance is expected soon from the government. The proposal is to manufacture these instruments, most likely with Italian collaboration, at two locations--one existing and one new. At a later stage, the Srinagar unit of the ITI will also be assembling one lakh additional telephone instruments.

The Bangalore unit will continue to produce 677 instruments developed by the ITI itself until it can straightaway change-over to the production of the electronic version.

Referring to the ITI's performance and its expansion plans, Mr. Rao admitted that its growth had not kept pace with the demand for telecommunication services. Now a new thrust was sought to be given to bridge the gap so that telecommunication services were given priority based on demand by the end of the decade as promised by the government. The ITI would be in a position to support the government with the equipment necessary to fulfil this promise, Mr. Rao said.

Imported Know-How to Go

He said it was not necessary for the ITI to undertake manufacture of all items necessary for this purpose. It was identifying a number of projects where state electronic corporations could supplement the ITI's efforts by producing items of same quality and reliability.

In the coming years, Mr. Rao said, the ITI's dependence on imported know-how would progressively come down. At present, roughly a little over 60 per cent of current production of the ITI was related to products either entirely developed by its own research and development or with improvements incorporated by it in co-ordination with the telecommunication research centre of posts and telegraphs department.

He said as part of the modernisation programme, substantial investments would be made in areas of design and process improvements. These include, among others, setting up of a modern printed circuit board facility of high quality and reliability and a modern hybrid micro-circuit facility to enable high degree of miniaturisation. This would pave the way for large scale manufacture of integrated circuits at present imported.

Mr. Rao said with over Rs. 10 crores of capital investment in equipment and facilities and over 500 highly qualified engineers, the ITI's R and D set up was one of the best in Asia. During the current plan period another Rs. 14 crores would be spent on R and D division. In recent times, the R and D wing had developed more reliable systems in transmission and switching. At present a low cost small earth station was under development, he said.

The ITI had already started producing a small nine-line rural small electronic exchange and would soon take up manufacture of a 1000-line digital switching system. A 200-line modern microprocessor controlled exchange for use as a terminal exchange in rural network would go for field trial shortly.

For teleprinter communication, a micro-processor controlled 200-line telex exchange hs been developed and will be produced shortly.

Mr. Rao said the ITI was ready with facilities to enter the electronic switching equipment manufacture with a French firm and would be manufacturing the well proven E ten B system of digital electronic exchanges catering to both local and transit applications.

The French firm would also transfer know-how for a more modern version it was developing, he said.

Mr. Rao said, the ITI's total production would reach Rs. 320 crores in 1984-85 if all the projects went through on schedule. For the current year, the production target had been fixed at a little over Rs. 180 crores. The total instruments production this year from all the units of the ITI would be over 5.5 lakhs, a new record. Of these 1,5 lakhs would be of the new design 677 instruments.

Referring to Rae Bareli unit, he said it would soon start producing the indigenously developed crossbar system. A limited collaboration had been entered into with Bell telephone manufacturing company of Belgium for this purpose. First supplies from this unit with imported components and subassemblies were expected to roll out next month, he added.

CSO: 5500/7239

PRODUCTION OF INDIGENOUS ELECTRONIC TELEPRINTER PLANNED

Bombay THE TIMES OF INDIA in English 13 Sep 82 p 5

[Article by S. Dharmarajan]

[Text]

MADRAS, September 12.

A SMALL investment, innovative ideas and value engineering in research and development in a public undertaking here have spared the country from being saddled with an obsolete technology.

Would-be collaborators in the production of electronic teleprinters might have succeeded in taking the country for a ride had not this R and D group acquired the assessment capability.

Parallel with the search for a collaborator this group in Hindustan Teleprinters Limited (HTL) worked on and produced an electronic teleprinter. It was of a generation behind the contemporary technology available with some of the multinationals in the field. But their effort in the area enabled the R and D to point out bluntly the obsolescence of the technology offered. The bidders then came with the latest version.

FOREIGN TECHNOLOGY

HTL's project for the manufacture of electronic teleprinters is hopefully to be launched early next year subject to the government's clearance of production technology from Philips of Holland, Olivetti of Italy or Sargam of France for the latest version. HTL has formed a special group of R and D to update its technology and to make the Indian version multi-lingual.

With nearly two decades' experience in printed text communication and an uninterrupted impressive performance record, HTL as part of its extensive modernisation and upgradation programme is setting up the unit for electronic teleprinters at Hosur. The World Bank has sanctioned a loan of Rs. five crores towards the capital cost of this project.

According to Dr. Seetharaman, chairman and managing director of HTL, the pricing of the machines will be competitive. Production to begin initially with the assembly of 8,000 units a year will be raised to 12,000 units in the second phase and to 20,000 later. He contends that the maintenance cost would be less and operation fatigue is minimised by feather-touch key board switches of lower operating pressure. Further, the mean time between failures or calls is estimated to be three times more than that of the conventional electromagnetic version. Needless to say, with the induction of the electronic teleprinter, the communication room will be less noisy.

Electronic memories holding up to 32,000 characters are being implemented in these units. This has enabled the incorporation of a range of features including vertical and horizontal tabulation, message editing, correction and the like. Another important feature is the capability for adaptation to multi-language or multi-script operation.

It can be wholly integrated with the public telegraph networks where because of increased communication, higher traffic flow could be generated. It will usher in electronic office of the future even in rural areas with minimum operational and maintenance staff.

USEFUL FALL-OUT

A fall-out for HTL from this diversification programme is a range of new electronic products lines like floppy disc drives, data modems and other computer peripherals. Negotiations are under way with prospective collaborators for the manufacture of floppy disc drives. Its R and D has made striking strides in respect of data modems and a series of generic equipment has been contemplated to fulfil the requirements of communication. Already, HTL has a licence to manufacture 500 numbers of data modems.

The confidence among the R and D group is justified by rising volume of trade enquiries. Incidentally, the R and D facilities including laboratories and the additional infrastructure are financed from the resources of

this company which for the last three years has been remitting to the national exchequer a dividend of Rs. 14.75 lakhs annually apart from paying nearly Rs. 3 crores as duties.

In the context of the decision to go electronic, HTL will stop manufacturing the conventional teleprinters. But Mr. Seetharaman assures that there would not be a single case of retrenchment. For, production of spares for 100,000 electro-mechanical teleprinter now in use would continue. Besides, most of the employees with a little in-house training are being inducted into the programme for manufacturing electric typewriters.

CSO: 5500/7246

BRIEFS

NORTHEAST TELECOMMUNICATIONS--The telecommunication network in the difficult terrain of the North-eastern region is to get a big boost with the provision of Rs 75 crores for its development during the Sixth Plan period, reports UNI. The Posts and Telegraphs department has initiated several measures for the expansion and modernisation of telecommunication services in the region including automatisation of manual exchanges at far-flung district headquarters. Provision of telephone connection practically on demand by 1985 and installation of automatic telephone exchanges at the district headquarters are some of the salient features for the region during this plan period. The seven microwave systems and 30 UHF systems have been planned for the execution during the current Plan to provide reliable and stable long distance transmission media. There is a proposal to open three more telex exchanges at Jorhat, Kohima and Silchar and expansion of telex exchanges at Shillong-Gauhati and Tinsukia to provide better telegraph facilities. Mokokchang, Kohima and Tuensang in Nagaland and North Lakhimpur in Assam have been selected as focal points for integrated telecommunication development in the region. [New Delhi PATRIOT in English 8 Sep 82 p 5]

TRANS-INDIAN CABLE LINK--MADRAS, Sept. 7--The Government of India is considering plans for a high grade trans-Indian microwave link between Bombay and Madras, dedicated to international traffic. This will link the IOCOM (Indian Ocean Communication) Madras-Penang submarine cable system with the Bombay-United Arab Republic cable service, now in an advanced stage of construction. This was reported by Mr. K. C. Katiyar, Director-General, Overseas Communications to the second management meeting of the seven Commonwealth nations' telecommunication administrations, who jointly own the 2500 km cable link between Madras and Penang, laid at a cost of over Rs. 30 crores by India. The IOCOM cable was the first broad band cable to touch the Indian shores and had proved its usefulness by providing a complementary medium to the Intelsat system, he said. According to circuit estimates by the Indian Ocean Data Gathering Group at Sydney, the IOCOM cable would reach the "fill" towards the end of the Eighties. [Madras THE HINDU in English 8 Sep 82 p 16]

LINKS WITH INTELSAT--NEW DELHI, September 8 (PTI)--Contacts have been reestablished between Port Blair and Madras earth station through INTELSAT, it was announced here today. Telecommunication channels have been put through between Port Blair and Madras and between Port Blair and Calcutta. The Delhi comunication link to remote and far-flung areas was cut off when INSAT-1A

failed to operate two days ago. A spokesman of the communications ministry said the posts and telegraphs department was making all-out efforts to re-establish contacts within the next three days with these areas which included Leh, Aizwal, Kavarathy and Car Nicobar through INTELSAT. Telecommunication links between the seven earth stations were connected through INTELSAT from 1980 and were switched on to INSAT-1A only last month after the launching of India's own domestic satellite in April. Out of 4,000 channels, which were available to the P and T department through INSAT-1A, only 300 channels had been used so far. It was proposed to increase the number of channels to 1,500 by this year-end. As a result, the spokesman said, the sudden failure of INSAT-1A had not affected much of the telecommunication links in the country as also the foolproof terrestrial links. [Bombay THE TIMES OF INDIA in English 9 Sep 82 p 5]

SPOKESMAN ON INSAT-1A--NEW DELHI, Sept. 9--Telecommunication links in the country have not been affected in any way by the sudden failure of INSAT-1A a spokesman of the Communications Ministry said yesterday, reports PIT. He said that out of 4,000 channels, which were available to the Posts and Telegraphs Department through INSAT-1A, only 300 channels had been used till now. It was proposed to increase the number of channels to 1,500 by the end of this year. [Calcutta THE STATESMAN in English 10 Sep 82 p 9]

PROGRESS ON INSAT-1B--BANGALORE, Sept 13 (UNI)--Work is going on according to schedule on the Indian National Satellite INSAT-1B slated for launch in July director of Indian Space Research Organisation's (ISRO) satellite centre Prof U R Rao told UNI here today. He was commenting on reports in a section of the press that work on INSAT-1B had been suspended following the failure of INSAT-1A and a high level ISRO team was rushing to the United States for discussions with the Ford Aerospace Corporation the manufacturers of INSAT satellites. Prof Rao said data relating to the defunct INSAT-1A which collapsed due to sudden depletion of on-board fuel, had been flown to California and the data had to be first analysed thoroughly. Any corrective steps on INSAT-1B would have to be made before the final space simultation tests. An Indian team might go over to the United States then he added. Meanwhile the efforts to re-establish contact with INSAT-1A has not so far yielded any result. The master control facility at Hassan would, however, continue its attempts, according to an ISRO source. The space scientists were trying to re-establish contact with the failed satellite to find out its exact health parameters at the time of its collapse on 6 September. [New Delhi PATRIOT in English 14 Sep 82 p 7]

CSO: 5500/7247

SATELLITE COMMUNICATIONS IN NEPAL

Kathmandu THE RISING NEPAL in English 22 Sep 82 p 2

[Excerpts] Mid-October, 1982 will unveil the age of satellite communications in Nepal. To that end, the highly sophisticated installation of the satellite earth station "SAGARMATHA" at Balambu in the district of Kathmandu has been completed by August 10, 1982. With the inauguration of the Sagarmatha Satellite Communications Station at Balambu in Kathmandu, Nepal joins the family of satellite communicators through the INTELSAT satellite 4 A & 5 over the Indian Ocean. From that day, Kathmandu's operator will be able to dial directly any international telephone numbers. With the operation of the 60 channel capacity of the Standard 'B' earth station, Nepal's communications with Europe in the west and Japan in the east will be highly faciliated. And telex will be fully automatic.

Coming to our Nepalese communications earth station "Sagarmatha", the project was undertaken under the joint collaboration of Nepal and the British Government. The £3.01 million British aid has contributed substantially in the overall implementations of the project-installation of the earth station equipment, the construction of Standard 'B' type earth station, installation of satellite terminal equipment in the international Telecommunications Building at Tripureswar. Marconi Communications International Company of United Kingdom, the contractor of the project, has speeded up the construction and installation to complete the entrusted works in time and as per schedule and project programme.

With Rs. 10 million of Nepal Telecom Corp, the International Telecom. Building at Tripureswar has been getting the finishing touches. Installation works have started briskly. The construction, the installation etc. are done in time.

The various mandatory and general testings of the earth station is underway in the month

of September of 1982 and by mid-October of 1982, the international telecommunication services with the help of satellite are expected to start. With the completion of this highly important project in the Nepalese Communications field Kathmandu's operator will directly dial international telephone numbers; the international trunk services will be quick and reliable; the telex ubscriber will also be able directly to dial the telex numbers throughout the world, i.e. the telex-services will be fully automatic; intercountry telex services will be available even outside Kathmandu valley.

CSO: 5500/4301

MOVES UNDERWAY TO ESTABLISH LOCAL SILICON CHIP INDUSTRY

Wellington THE EVENING POST in English 26 Aug 82 p 30

[Text]

THE DSIR has begun moves that could see the birth of a silicon chip industry in New Zealand.

The director of the physics and engineering laboratory for the DSIR, Mr Richard Morris, said today that space had been set aside in the Lower Hutt laboratories to establish a programme that could, among other things:

- Train the next generation of engineers and physicists in silicon technology.
- Set off new research in various fields of the technology.
- Increase the chances of attracting a major "wafer fabrication plant" (silicon chip factory) in this country.

Students

He said the first steps had been completed and by 1985 it was hoped to be in full operation, with universities already indicating that by then they would expect to supply 20 students to take part in research and development work.

Speaking to the national electronics conference in Wellington, Mr Morris said the worlds of electronics, aeronautics, space technology and even such things as biotechnology and defence programmes were now dominated by silicon technology.

He said that now was the time for New Zealand industry to enter the field, with the impending availability of silicon-chip-types by the end of this decade at economic prices.

The industry's competitors overseas were similarly moving with the times, and some countries such as Singapore, Hong Kong and South Korea were setting out to dominate the production markets.

Equipment

The DSIR was getting its first equipment from California — second hand — this year.

Mr Morris said the silicon technology section would come under the charge of Dr Mike Andrews, a physicist from Edinburgh University.

CSO: 5500/9038

BRIEFS

GUANGZHOU-SHANTOU MICROWAVE LINE--The Guangzhou-Shantou TV and broadcasting microwave main line has been installed. After test and trial, the quality of the line is good. The line will be used from 1 October. From the National Day, people in the eastern part of Guangdong Province will be able to watch TV programs which will be clearer than those at present. This microwave line is some 390 km long. Microwave stations have been set up in Guangzhou, Dongguan, Huiyang, Zijin, Fengshun and Shantou. After this line is used, a frequency channel will be used to transmit a color TV program and two broadcasting programs. [Guangzhou Guangdong Provincial Service in Mandarin 2350 GMT 27 Sep 82]

GUANGDONG BUILDS MICROWAVE TRANSMISSION NETWORK--Guangzhou, 27 Sep (ZHONGGUO XINWEN SHE)--The construction of a microwave radio and television broadcasting network linking Guangzhou and Shantou was recently completed, and will be put into operation on 1 October. In addition to this, a branch network linking Guangzhou with the Shenzhen and Zhuhai special zones will be built up later. This is the first relatively long-distance microwave radio and television transmission network for Guangdong Province, of which all the equipment is domestically produced. When put into use, this network will be in charge of transmitting one color television channel and two radio programs to eastern Guangdong, covering Huiyang, Meixian, Shantou and other prefectures. The completion of this network will expand the radio and television broadcasting service area, as well as improve the reception in eastern Guangdong. Another two microwave networks are planned for Guangdong Province: One linking Guangzhou with Tongshi of Hainan Island, and the other linking Guangzhou with Ruyuan. With more than 1.5 million television sets, Guangdong is the province with the most television sets in China, and television viewers account for 70 percent of the province's population. [Text] [HK280805 Beijing ZHONGGUO XINWEN SHE in Chinese 1313 GMT 27 Sep 82]

CSO: 5500/4100

DIRECT DIALING FACILITIES SOON TO ALL AREAS

Colombo THE ISLAND in English 11 Sep 82 p 2

[Article by D. B. Wijetunge]

[Text] "AT present the Direct-dialling facility has been extended to almost every part of the country except Jaffna and Kurunegala. Within two months each and evey town in Sri Lanka would get this facility " said the Minister of Post and Telecommunications Mr. D. B. Wijetunga at the ceremonial inauguration of the new Direct-Dialling Auto-Exchange Centre in Badulla.

Prime Minister R. Premadasa inauguratedl the Direct-Dialling Auto-exchange cabin by lighting the traditional-oil lamp amidst the chanting of Seth-Pirith by the Maha Sangha.

Mr. Wijetunga further said — "It was an advancement of a developing country to obtain the facilities of direct-dialling. The Government had spent about Rs. 500lakhs for the construction of this centre with the assistance of the Japanese Government. At present there are about 500 subscribers, and with the opening of this centre arrangements will be made for the extension of further facilities for about 650 subscribers in the Badulla area, he added.

This Auto-Exchange system is guaranteed for about 50 years, and on the sixteenth of this month, another Direct-Dialling Auto Exchange centre with be commissioned at Chilaw, the Minister said.

Continuing the speech the Minister further said — "when this government came into power in 1977, under the leadership of President J. R. Jayewardene, this country had a dead Telecommunication service and the present government had to make an active effort to give life to the upliftment of this dead system.

The M.P. for Badulla Mr. Vincent Dias also addressed the meeting.

CSO: 5500/4300

BRIEFS

NEW RADIO, TELEVISION STATIONS--At its regular meeting on Wednesday, the broadcasting directing board granted permission to set up a new television station and two more radio stations in the country. The television station is controled by the Public Relations Department. It will be set up at Khao Samo Klaeng, Muang District of Phitsanulok Province. The station will telecast on Channel 11, but will need more budget to buy needed equipment. The budget is yet to be received from the government. Therefore the department will have to use Channel 7 in the meantime and will switch to Channel 11 at the earliest possible date. Of the two radio stations, one will be controled by the Public Relations Department and will be set up in Rat Buri Province. The other will be controled by the 2nd army region and will be set up in Kalasin Province. Both stations will have 10 kilowatt transmitters. [Text] [BK121205 Bangkok Domestic Service in English 0000 GMT 10 Sep 82]

CSO: 5500/4302

BRIEFS

EDUCATIONAL RADIO STATIONS--A program called "The Teacher at Home" will result in the creation of 28 education radio stations in Costa Rica. Each station will cost 7 million colones. The princess of Liechtenstein is in Costa Rica to dedicate the cultural radio network. Her father is the president of the communications network of the principality of Liechtenstein and her government is financing these educational radio stations. Approximately 10 years ago, an institution was formed in Costa Rica to operate a project called "The Teacher at Home." These radio stations derive from this project. The Austrian Embassy official in charge of cultural affairs in Costa Rica has said this is a pilot project in Latin America. For the time being, only seven radio stations will be dedicated throughout the country. [PA291521 San Jose Radio Reloj in Spanish 1200 GMT 28 Sep 82]

CSO: 5500/2002

DAILY REPORTS NEW TELEVISION TRANSMITTER

GF201946 Tehran JOMHURI-YE ESLAMI in Persian 11 Sep 82 p 4

[Text] Tabriz--Mr Mohammad Hashemi, the director general of the Voice and Vision of the Islamic Republic of Iran, who had gone on a visit to the east Azarbayjan Province with some of his advisers in order to survey the prospects and deficiencies of the Voice and Vision of the Islamic Republic of Iran, left Tabriz for Tehran yesterday afternoon.

During his tour, Mr Mohammad Hashemi met Ayatollah Malakuti, the imam's deputy in Azarbayjan, the Tabriz Friday imam, Ayatollah Meshkini, Seyyed Hoseyn Musavi-Tabrizi, chief revolution prosecutor and Dr Ghafuri-Fard, the energy minister, who are now in Tabriz to attend the weeklong martyrdom anniversary ceremonies of the great martyr Ayatollah Madani.

The director general of the Voice and Vision of the Islamic Republic of Iran spoke to the correspondent of the central news unit, Tabriz center, at the end of his visit to eastern Azarbayjan regarding the elimination of the deficiencies of the transmission of the Voice and Vision of the Islamic Republic of Iran in the border areas of northern Azarbayjan, and said that the Mughan radio center will reach its optimum capacity and next month, a 10-kilowatt transmitter will be set up in the Mughan district.

CSO: 5500/4701

MADE-IN-IRAN COMMUNICATIONS SPARE PARTS EXHIBITED

Tehran KEYHAN in Persian 5 Sep 82 p 6

[Interview with Engr Va'ezi, managing director of the Iran Communications Company]

> [Text] About 1,000 kinds of parts needed for the communications of the country were displayed in an exhibition for the Iranian industrial workers and builders to move towards industrial self-sufficiency through the blossoming of the talents and encouragement of the Iranian industrial workers.

The exhibition for the needed spare parts of the communications company called Shahid Shahrokh Tahmasebi, was opened yesterday morning with recitations from the Koran in the presence of the managing director and the authorities of Iran Communications Company at the Payam Club. In this exhibition, which will be open until next Sunday, 12 September, from 0800 to 1400 hours, except for holidays, about 1,000 kinds of spare parts needed for the communications systems of the country will be displayed. The material for and kind of these spare parts range from the most simple to the most complex and are parts which can be produced in Iran. The owners of all vocational and small workshops can choose any part which suits their own trade and take steps to produce it.

In this regard, Engineer Va'ezi, the managing director of Iran Communications Company, said to the correspondent of the ISLAMIC REPUBLIC NEWS AGENCY: The establishment of this exhibition for the purpose of providing the short term needs of the Communications Company and ultimately industrial independence from abroad follows the establishment of the industrial office of this company. This exhibition is the first step towards introducing the sample spare parts which can be produced domestically with instructions to the Iranian manufacturers. This equipment is mostly for city and intercity telephones, cables, and energy. The next step is to display microwave parts.

Responding to the question of what resources and facilities will be placed at the disposal of the volunteer manufacturers, he said: If we are assured that a volunteer is able to manufacture the needed part, all kinds of resources will be placed at his disposal.

Concerning telephones for the industrial centers for agricultural production and services which are located on the roads around Tehran, he said: These centers have been identified and their requests will be granted after studies are made and priority will be given to the needs of the society. The cable installations along the Karaj and Saveh roads have been completed for 140 telephones which will be installed and the rest are being installed.

Engineer Va'ezi also said: We are planning in this area to establish centers to handle 500-1,000 numbers along the roads so that factories located along the roads will have no communication problems in the future.

Concerning the transfer of telephones in Tehran, he said: If it is technically possible and the necessary conditions exist for the applicant, telephone transfers will be done.

Concerning providing telephone communications in the war regions, Engineer Va'ezi said: This job began a long time ago and still continues. Thusfar, we have been able to establish communications for the needs of the organizations, even in the villages.

Concerning the possibility of granting new telephones to applicants in the provinces and Tehran, the managing director of the Communications Company said: According to plans, we give priority to the provinces and the deprived areas of the country. The establishment of these exhibitions to provide the needed equipment is for the purpose of bringing services to the deprived provinces as soon as possible. In regards to Tehran also, since the preparations have been made previously, efforts are being made, without decreasing the resources of the deprived provinces, to grant telephones, giving priority to those who have telephone receipts. Possibly by the end of next year, in addition to the new telephones, 18,000 more telephones will be installed for the residents of Tehran.

Concerning the exhibition of the needed equipment by the Communications Company of martyr Tahmasebi, the director of the industrial office of the Communications Company and head of the exhibition said to the correspondent of the ISLAMIC REPUBLIC NEWS AGENCY: Presently, a great number of the spare parts needed by the Communications Company are produced domestically and the contracts for a number of other parts have been signed with

Iranian industrial workers and factories and they are being manufactured. About 1,000 needed communications spare parts which were not previously produced domestically are being introduced to the manufacturers in this exhibition. Efforts will be made to change about 20 percent of the equipment to several forms, taking into consideration the variety and limited needs, in order to make these projects feasible for the manufacturers.

'PANA' TO HOLD TECHNICAL MEETING IN DAKAR

AB121611 Lagos NAN in English 1600 GMT 12 Oct 82

[Text] Dakar, 12 Oct (PANA/NAN)--The Pan-African News Agency (PANA), will host the PANA Technical Committee meeting from 26 October to 30 October, at the agency's headquarters in Dakar, Senegal.

This committee, established by the inter-government council of the agency, is composed of technical directors from the PANA regional pool headquarters--Libya, Nigeria, Senegal, Sudan, Zaire, Zambia--as well as UNESCO and ITU experts.

Its objective is to study and propose solutions to problems related to PANA equipment and telecommunications links.

At its last session in June, the technical committee decided on the specification and quantity of the equipment to be installed at PANA Central Headquarters in Dakar, as well as in its regional offices, in Lagos, Kinshasa, Khartoum, Lusaka and Tripoli.

The technical committee will also review the needs expressed by national news agencies requesting assistance for necessary equipment to ensure the transmission of their news to PANA pool regional headquarters when the agency starts its operations.

CSO: 5500/9

JAPANESE AID FRENCH, SWEDISH SATELLITES

Paris LES ECHOS in French 6 Sep 82 p 9

[Unsigned article]

[Text] The Japanese electrical company, Mitsubishi, has just received two contracts representing 14 million dollars, to supply ground station equipment to the organization for the European telecommunications satellite (Eutelsat), and to the Swedish Telecommunications Administration (STA).

According to Mitsubishi spokesmen, the contract with Eutelsat covers the design, fabrication, and installation of high performance TDMA (time division multiple access) communications equipment for the Fucino (Italy) and Guadalajara (Spain) stations.

The launching of an European communications satellite is expected next year. According to the Japanese company, the equipment supplied by Mitsubishi should be placed in operation in 1984.

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CSO: 5500/2355

FIRM DEVELOPS COMPUTER-DATA PHONE WITH BUILT-IN TELEPRINTER

Copenhagen BERLINGSKE TIDENDE in Danish 8 Sep 82 Sect III p 1

[Text] A telephone with a built-in teleprinter which gives the current exchange rates and security prices was one of the new products presented at the opening of the HI Fair [Handicrafts and Industrial Fair] in the Herning Halls yesterday.

The computer-data telephone has been developed by the Jutland Telephone Company, Inc., and is marketed through the Private Bank, whose foreign exchange department the computer-data phones are connected with. The computer-data telephones may be used by, among others, potential customers of medium-sized enterprises who need to follow the fluctuations in exchange rates and security prices.

So far 50 computer-data phones have been sold in Denmark, but there are indications that more computer-data phones will be sold. For, during the first 3 hours of the fair, another 3 computer-data phones were sold. In addition to the dry figures, the phone may also supply comments on, and background information to, the fluctuations in exchange rates and security prices. If any major fluctuations should occur in security prices or exchange rates, the enterprise concerned may immediately pick up the receiver, call the bank, asking it to start buying or selling.

The HI Fair, which is one of the largest fairs in Scandinavia within the building and construction sector, was at its opening met with pessimism in respect of the future of the building and construction industry. Representatives of the Council of Handicrafts and the Association of Building Contractors expect the crisis within the building and construction industry to develop into a disaster of bankruptcies and high unemployment rates.

Erik Teilmann, Bank Officer Authorized to Sign on Behalf of the Private Bank, tests the newly developed computer-data phone

7262
CSO: 5500/2349

THIRD STAGE OF ARIANE ROCKET FAILS, TWO SATELLITES LOST

Possible Consequences

Paris LE MONDE in French 11 Sep 82 pp 1, 10

[Article by Jean-Francois Augereau: "The Ariane Failure"]

[Text] The first commercial flight of the European rocket Ariane was a failure. Ten minutes after blasting off from the Kourou (Guyana) Space Center at 0412 hours (French time) on 10 September, a still unexplained malfunction caused the rocket's third stage to fail. The rocket and its two satellites were destroyed shortly thereafter.

The Ministry of Research and Industry issued a statement Friday morning saying that "The telemetry data at the Natal (Brazil) station must be analyzed to determine the cause of the failure" and that "Of course, the Ariane program continues." At the ESA [European Space Agency], Mr Michel Bignier, manager of space transport systems, expressed concern, above all, regarding the delay this could mean with respect to forthcoming launches.

A Serious Setback

The European space effort has suffered a serious setback with the failure of the Ariane rocket's first commercial flight. For the second time in five flights--Ariane had already exploded in flight during its second test launch--the European launcher has failed to accomplish its mission and placed its backers in an unenviable position at the very moment it was beginning to breach the monopoly the Americans have held, for many long years, in this domain.

It is a severe setback in the sense that the duration of the investigation, to determine the exact causes of the failure of the rocket's third stage, will probably upset, once again, the schedule of forthcoming launches. It is, in fact, reasonable to doubt that the next launch will be able to take place in November as presently scheduled.

But most importantly, the question is "How are those responsible for the program, who were already walking a tightrope even before 10 September, going to be able to efface these many mishaps. Ariane's first commercial flight had already been delayed by almost 5 months beyond its originally scheduled date of 23 April. Of course, this delay in the launching was not owing to any problem with the launcher, but rather to the modifications that had to be made to one of the satellites it was carrying up yesterday.

It is a financial setback as well, the more so in that a technical investigation is always costly.

The expenses involved in the present instance will have to be added to the developmental cost of the launcher--5,010 million francs based on the economic conditions of July 1981--which the Europeans had, as a point of pride and justly so, kept within its original budgetary envelope. What is more, besides paying to know why, profits and losses will have to be charged not only with the 180 million francs representing the cost of the lost launcher, but also with the 150-160 million francs representing the developmental cost of the scientific and technical satellite SIRIO-2, plus the cost of the maritime telecommunications satellite MARECS-B whose lost opportunity to do business is only partially covered by the $20-million insurance policy taken out prior to the launch.

The final tab will be even higher, since the MARECS-B satellite, whose orbiting was being anxiously awaited, was to be used entirely for commercial purposes. Once in place, it was actually to be integrated into the maritime satellite telecommunications system of INMARSAT [International Maritime Satellite Telecommunications Organization]. INMARSAT had planned, by means of an array of six satellites--three INTELSAT-5's, one Comsat General Corporation MARISAT satellite, and the two European satellites MARECS A and B--to make it possible for ships at sea, crossing the Atlantic, Pacific or Indian Oceans, to communicate directly with land by telephone or telex by simply dialing the subscriber's number, but also to rapidly relay search and rescue messages from any ship to shore.

The absence of MARECS B from its position east of Australia will--for these reasons and even though, according to INMARSAT officials, this will not disrupt services--translate for the ESA as a substantial loss of opportunity to do business, depriving it of all but a part of the $13 million of planned revenue from the leasing of the two MARECS satellites.(1)

Entitled To a Failure

In sum, it is an economic setback for Europe's space effort, insofar as the credibility of its launcher has been somewhat shaken. The satellite owners are,

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(1) The first MARECS flight model, stationed over the Atlantic, encountered some operational problems that have now been resolved. Since March, MARECS A has again been operating normally. But modifications had to be made to MARECS B to avoid similar problems. This took several months and explains the postponement of Ariane's first commercial flight to September.

of course, pragmatic people and know perfectly well the risks of the business. It is therefore reasonable to suppose that the Arianespace company, the marketer of the launcher, will not suffer any defections from its bulging roster of launch bookings, totaling around 3 billion francs. On the other hand, however, potential clients who were on the verge of booking with Arianespace will probably postpone the signing of their contracts, to say nothing of the possibility of their turning once again toward the United States.

To speak of such an outcome as regrettable, after the marketing success the Europeans had reached in their effort to crack the American monopoly on satellite launching services, is putting it mildly. True, it was a modest success, considering the potential of the market as a whole. In a way, however, the bet had been won; as witness, the contracts that had been signed with Arianespace by three American firms: Southern Pacific, Western Union and GTE.

These successes, however, have, to a certain extent, been wiped out by last night's failure. It can always be argued that Ariane is only now experiencing its debut and that, from this viewpoint, she is entitled to a failure. This is entirely true and, in the past, certain conventional American rockets, being held up today as an example, have experienced a much higher rate of malfunctions than has Ariane, which has functioned perfectly three times. This excuse, however, bears up poorly in a marketing context, where the only thing that counts is results, and the more so since, as of today, and despite the errors committed by it in the past--strategic, technical and financial--the competition, with its conventional Thor Delta launcher as well as its space shuttle, has chalked up an impressive number of successful launches.

What, then, is to be done at this point, knowing that, 2 months from now, the shuttle is scheduled to make its first commercial flight? Work and work fast toward a new success to restore the lost luster to the fortunes of Ariane, which, it must be agreed, had earned her honors from the technical standpoint as well as the financial one, thanks to her lower launching costs than those of her American competitors. There is, however, a subtle aspect that must be faced, in that, owing to yesterday's failure, Ariane's forthcoming commercial flight and the one that succeeds it will, to a certain extent, also be test flights, insofar as the SYLDA double-launching system (LE MONDE, 9 June 1982), on which the future profitability of the launcher rests, has yet to be flight tested.

[Boxed insert follows]:

A 'Near Perfect' Launch

It was just as the technical experts were beginning to believe it had been a "faultless" launch that something happened causing it to fail. What, in fact, did happen? It would be Friday night, at the earliest, before this could be known--not before the first analyses of the magnetic tapes that had been recorded at the Natal (Brazil) station and that would have to be brought to Kourou by plane. These magnetic tapes would enable the nature of the malfunction to be determined: A fault in the third stage engine, or a malfunction in the guidance system, or even the outright breakdown of an electronic component.

Before that, the chronology, as the technicians call it, had been perfect. At the appointed time--0412 hours, French time--the first stage was fired up. It behaved perfectly, as did also the second stage; ejection of the fairing and separation from the third stage took place normally. For 4 minutes, the third stage functioned well. At this point, 10 minutes of flight had elapsed, the launcher was beyond the range of Kourou's radars, and the telemetering signals transmitted continuously by the launcher were being recorded at Natal. It appeared then that the launcher was not following its trajectory and was losing altitude. Two minutes later, the American station installed on the mid-Atlantic British island of Ascension was to take over from Natal. Ascension did in fact "acquire" Ariane for a few seconds and verified that the launcher was far off of its normal trajectory. It then lost the launcher, whose third stage and the two satellites it was carrying disintegrated in the upper atmosphere.

Reason For Failure

Paris LE MATIN in French 13 Sep 82 p 15

> [Text] It was the malfunction of the fuel turbopump that feeds the third stage's engine that caused, on Friday, the failure of the Ariane rocket's first commercial flight and the loss of the two satellites MARECS B and SIRIO-2. The technicians of the Kourou Space Center in Guyana have determined the reason for the mishap in record time. It remains now to determine the exact cause of the malfunction and to then modify the faulty component. The immediate consequence of this will be to delay --possibly to January--Ariane's sixth launch. Beyond this scheduling problem, the officials of the Ariane mission are confident that this failure will not compromise the commercial future of the European rocket.

Things did not drag. Less than 24 hours after the failure of Ariane's fifth launch, the general manager of the CNES [National Center for Space Studies], Frederic d'Allest, was able to state, in a press conference held at Kourou on Saturday, that the mishap originated in the malfunction of the turbopump that feeds liquid oxygen and liquid hydrogen to the cryogenic engine of the launcher's third stage.

To localize this faulty component, some 100 technicians, divided into several working groups, had to systematically process the telemetry data that had been recorded by the Natal station in Brazil and sent by plane to Kourou early Saturday afternoon. One by one, the various on-board equipments and the various functions were eliminated as the cause. Then, the group charged with studying the operation of the third stage detected, at H hour + 561 seconds, that is, 4 minutes 23 seconds after ignition of the stage's engine, "a drop in speed of the turbine, followed by a pressure drop inside the engine's combustion chamber."

Since the fuel tank and pressurization system pressures were correct, the technicians concluded that the source of the propulsion dropout could only be in the turbopump that injects the propellants (liquid hydrogen and liquid oxygen) into the cryogenic engine.

It remains now to determine why the injection system failed... This turbopump," explained Mr Moulaert, chief of the Ariane mission, "is to the rocket somewhat as the crankshaft is to your automobile. Now, even in the best of automobiles, the crankshaft can give way. A tiny flaw, a cleft in the steel, and the piece breaks without warning. For the moment we can only hypothesize." And these hypotheses will have to be checked, in France, by the experts of the CNES and of the SEP [European Propellant Company], which builds engines and turbopumps at Vernon.

A fault, involving gearing breakdowns, had already been found in this type of turbopump during the rocket assembly and test phases. But it was corrected and there is no reason to assume that Ariane 5 was the victim of such a breakdown.

"Considering the volume and quality of available data, the diagnosis and any eventually needed modification of the turbopump should not take too long," Frederic d'Allest emphasized.

The next launch, which had been scheduled for 23 November, will, in the prevailing opinion at Kourou and under the best of circumstances, not be able to take place until next January.

Beyond merely upsetting a heavily loaded schedule, what can be the consequences of this failure of the first commercial flight? "This kind of mishap is extremely troublesome," commented Frederic d'Allest, "but not abnormal at this stage in our program. We feel that the potential users of Ariane will retain their confidence in us." And, in a communique, the minister of research and industry, Jean-Pierre Chevenement, stated that this failure "will in no way put to question again the rocket's capability," adding that "Ariane has spun a robust thread that will not be broken, for, it is that of our technological, economic and cultural independence."

Feigned optimism? Perhaps not. Present on Friday at Kourou, Olof Lundberg, general manager of INMARSAT [International Maritime Satellite Telecommunications Organization]--for the account of which Ariane was to have orbited the MARECS B satellite--reasserted: "We need competition in the realm of satellite launchers." Apparently, therefore, nothing has been lost, even though Friday's "miscarriage" may complicate negotiations between Arianespace and those potential clients who were lured by Ariane's initial performances...

Launch Calendar Before Failure

Paris LE MATIN in French 11 Sep 82 p 30

[Excerpt] Following is the calendar of Ariane's next 20 launchings between now and year-end of 1985. This calendar may be altered because of the failure of the

fifth launch. The resultant delays will depend on the cause of the failure, which is still unknown, not to mention possible loss of optioned bookings beyond August 1985. Nine of the Ariane rocket's 20 booked launchings are to be carried out by means of the SYLDA [Ariane Double Launch System] developed by SNIAS [National Industrial Aerospace Company] which enables the simultaneous launching of two satellites: The SYLDA was to be tested for the first time with the putting into orbit of the MARECS B and SIRIO-2 satellites.

Calendar of Ariane Launchings Before Failure

(1) Date	N° du lancement	Satellites	Nation	Mission
(2) **FERMES**				
Nov. 82	L6	*Exosat*	ESA	Astronomie
		ECS 1		Télécommunications
Jan. 83	L7	+ *ASCAR 9*	ESA	Radios
		(3) (lancement double)		
Mars 83	L8	*Intelsat-5* 1er vol (4)		Communications
Mai 83	L9	*Intelsat-5* 2e vol (4)		Communications
		ECS 2	ESA	
Juil. 83 (14)	L10	+ *Telecom-1* ou (5) *Intelsat-5*	France	Communications
		Intelsat-5 3e vol (4)	ESA	
Oct. 83	L11	+ *ECS 2* ou *Telecom-1*	France	Télécommunications
Déc. 83	L12	*Westar*	E.-U. (6)	Télécommunications
		Spacenet 1	E.-U.	
Fév. 84	L13	+ *Arabsat 1* ou (5) *Telecom 1-B*	Arabe France	Télécomunications
		G Star N° 1	E.-U. (6)	
Mai 84	L14	+ *Telecom 1-B* ou (5) *Arabsat*	France Ligue arabe (7)	Télécommunications
		G Star N° 2	E.-U. (6)	Télécommunications
(13) Août 84	L15	+ *Spacenet N° 2*	E.-U.	
		Spot 1	France	Observation
Oct. 84	L16	+ *Viking* (12)	Suède	de la Terre (8)
Déc. 84	Créneau libre (9)			
		SBTS N° 1	Brésil (10)	
Fév. 85	L17	+ *Spacenet* ou (5) *ECS 3*	E.-U. (6)	Télécommunications
Mars 85	L18	*Intelsat 5 A*		Communications
Mai 85	L19	*TV Sat* (11)	RFA	Télévision
		Intelsat 5-A ou (5)	France	Télévision directe
Juin 85	L20	*TDF-1*		
(14)		*Giotto*	ESA	Survol comète Haley (15)
Juil. 85	L21	+ *STC 1* (6)	E.-U.	Télévision directe
OPTION				
Août 85 (13)	L22	*Aussat*	Australie	Communications
		TDF-1	France	Télévision directe
Sept. 85	L23	(5) ou *Intelsat-5-A*		
Sept. 85	L24	*ARIANE 4*	ESA	Premier vol (16)
Déc. 85		*Aussat*	Australie	Communications
		L25	+ *Anik-B*	Canada

Key:

1. Launch Number.
2. Firm Bookings.
3. Double launching.
4. Vol=Flight.
5. Ou=Or.
6. E.U.=United States.
7. Arab League.
8. Earth Observation.
9. Open slot.
10. Brazil.
11. Federal Republic of Germany.
12. Sweden.
13. August.
14. July.
15. Flyby of Haley Comet.
16. First flight.

9399
CSO: 5500/2354

NATION TO SEEK 15 PERCENT OF WORLD TELEMATICS MARKET

Paris LES ECHOS in French 31 Aug 82 p 4

[Article by J. J.]

[Text] France is resolutely pursuing the telematics path. Louis Mexandeau has taken stock and found telecommunications electronics to be a potentially very lucrative contribution to France's trade balance and industry.

The national technology will thus be found in the air and on land to cover all wavelengths. The first TDF-1 satellite should be launched during the summer of 1985, after an investment of 1.27 billion francs, as the PTT minister stated in his answer to a written question from Deputy Michel Noir (Rally for the Republic, Rhone).

This could lead to a world market for direct broadcast satellites estimated at about 15-18 billion francs in 1990, from which France expects to draw 2.0-2.5 billion francs for its European cooperation activities.

Same determination for cable television and data transmission, particularly using optic fiber technology, which makes it possible to send hundreds of communications through a fiber the size of a hair.

The first volunteer users in the cable-equipped town of Biarritz will be connected in mid-1982. The operation will cost a total of 500 million francs. This activity is considered to amount to several billion dollars on the world market in 1990.

The objective for the French industry is to capture 15 percent of sales, which means a business volume of some 10 billion francs at the least.

Who Will "Liberate" the Airwaves?

But how will the French be able to choose between satellite and cable, since the government, through the PTT minister, has undertaken the obligation to offer two possibilities to users, when the television satellites begin operations? Louis Mexandeau, aside from policy, suggests an economic answer. A parabolic direct reception antenna, would cost between 2365 and 4180 francs in 1982, depending on the geometric angle between the building involved and the satellite.

A share in a community television cable network would be a minimum of 1925 francs, and could reach 3850 francs, depending on distance.

The differences appear surprising at first sight, since various experts had indicated that cable television, called teledistribution by specialists, would be much less costly than satellite television. But PTT hastens to point out that a community network would offer many more services than a direct reception antenna.

Among other things, Louis Mexandeau talks of local and regional or interactive services, which can be connected to cable. After local radio, the time will have arrived for regional television; but while the transmission technology is already available, no political decision has been reached about program content or about who will have the right to "liberate" the airwaves.

The question is still open, independently of whether it applies to a local scale or to the airwaves, with the fourth or fifth channels offered by the satellites.

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PTT SEEKS TO SPREAD TELEMATICS USE THROUGHOUT NATION

Paris LES ECHOS in French 7 Sep 82 p 22

[Article by Gerard Larpent]

[Text] From our correspondent in Aquitaine. Despite the belt tightening policy adopted by the government, Louis Mexandeau, PTT minister, is not too worried about his own budget. That is what he indicated on Monday in Bordeaux, at the opening of the 21st European Meeting of Telecommunications Engineers, which will continue until 11 September.

The 142 billion-franc telecommunications budget is the country's third largest, and the largest for civilian investments; it devotes 28 billion francs to investments during this year, and should receive an equivalent amount next year (on the order of 28-30 billion francs). Together with telematics activities as a matter of course, the completion of switching center equipment, and the continuation of the telephone equipment programs, which Mr Mexandeau expects to be finished in 1985, will be the major projects in this category.

The minister points out that in 1981 the budget stipulated the installation of 300,000 Minitel (electronic telephone directory) terminals. The same number of terminals was included in the 1982 budget, and Mr Mexandeau believes that the same figure should be expected for 1983, by which time the total number will come close to one million units. The development of this technology should be accelerating, to achieve a complete "telematics irrigation" of the country within 15 years.

The minister nevertheless stated that unlike his predecessors, he did not intend to impose this technology, but rather call upon volunteer participation. And experience has shown that demand is already very strong under these conditions, since in Ille-et-Vilaine more than 50 percent of the private subscribers expressed their desire to be provided with a telematics directory.

After Picardie, Nord-Pas-de-Calais and other regions, such as Aquitaine in July, stated that they wanted to receive this equipment; to such an extent, that the minister believes priorities will probably have to be established. But just as systems of refundable deposits existed for telephone equipment, Mr Mexandeau expects that a similar contractual policy for telematics equipment could be formulated with the regions.

"But it would be regrettable," the minister adds, "if as a result of inertia, some regions continue to lag in their development." That is why he advocates a decentralized procedure which will make it possible to respond to smaller collectivities, or even professional groups, which would request telematics equipment.

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BRIEFS

CONTRACT WITH NORTH YEMEN--France and North Yemen have established a protocol for technical cooperation in telecommunications. According to this agreement, signed by the French PTT minister, Louis Mexandeau, and his North Yemen counterpart, Ahmed Al Anissy, North Yemen, which was the first country in the world to benefit from the French E-10 technology, will have its capabilities increased to 100,000 circuits in 1985; it has decided to purchase a new E-10 telephone exchange for Sanaa. During his visit, Mr Mexandeau also met with the North Yemen prime minister, Mr Al Iriani. [Text] [Paris LES ECHOS in French 6 Sep 82 p 9] 11,023

CSO: 5500/2355

INTRODUCTION OF OPTICAL FIBERS IN DISTRIBUTION NETWORK

Turin ELETTRONICA E TELECOMUNICAZIONI in Italian May-Jun 82 pp 92-96

[Article by U. De Julio, F. Lombardi and R. Pietroiusti*]

[Text] Summary--Optical fiber introdution in the distribution network. The recent development and improvement of optical fibers and optoelectronic technology has suggested the possibility of introducing optical transmission systems in the distribution network. This paper presents a short analysis of the possible evolution of the distribution network and the expected requirements in terms of transmission capacity. Then, the main characteristics and performance of optical fibers and systems suitable for the subscriber network are discussed. On the basis of preliminary cost considerations, a widespread diffusion of optical fibers in this area of the network requires substantial reductions of fiber, cable and installation cost.

1. Introduction

The first field experiment with optical fibers in Italy goes back to 1976. Since that time, various other experiments have been conducted with the purpose of testing various techniques for the laying and joining of optical cables, checking the stability of the fibers in the cables laid and the performance characteristics of the digital-transmission systems at the various frequencies, up to 140 Mbit/s (Bibliography 1).

Until now, these experiments have been done only on the junction network between exchanges, for the purpose of comparing, from a technical-economic point of view, the optical cables with the traditional ones--that is, with coaxial-pair cables of 0.7/2.9 mm and 1.2/4.4 mm.

The results available have already demonstrated the suitability of the optical transmission systems in urban junctions and in short-distance interurban connections without intermediate repeaters with remote power supply.

The last experiment (started at the end of 1980) consists in an aerial optical cable to be used in the sector area with 2,048- and 8,448-Mbit/s digital systems.

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* Engineer Umberto De Julio, Engineer Franco Lombardi, Engineer Romolo Pietroiusti of the SIP - Rome. Manuscript received 27 January 1982.

At the same time, a great deal of attention has been directed toward the distribution network that connects the users to the local exchanges. This part of the network, which at present is completely analog and is used almost exclusively for telephone subscribers, will in the coming years undergo a gradual and profound change, for the following principal reasons:

I--the introduction of digital techniques, which suggests distribution-network structures different from the present ones.

Today, indeed, almost all subscribers are connected directly, with dedicated circuits, to their relative local exchanges, which fulfill the functions of concentration and switching. Typically, these circuits are composed of symmetrical pairs with diameter of 0.4 and 0.6 mm, and have an average length of about 1.7 km and maximum length of about 5 km.

With the use of digital techniques, it may prove appropriate to increase the average distance between the subscribers and their exchanges by using intermediate digital multipliers or concentrators of reduced capacity (from a few 10's to a very few hundred subscribers);

II--the present studies and developments of the Integrated Service Digital Network (ISDN) look forward, in addition to digital circuits for telephone subscribers only, to digital circuits at 80 (64 + 16) kbit/s and 144 (2 X 64 + 16) kbit/s for multiservice subscribers.

In the present distribution network, there are many factors that limit the repetition pitch obtainable at these frequencies--for example, the considerable diaphony between lines, the impulse noise, the presence of branches in parallel, the presence of other types of systems and signals;

III--the anticipated demand for access to wide-band networks. In this category are digital access to the frequencies of, for example, 2,048 kbit/s for private exchanges (PABX) and access to wide-band video services in analog form (with 5-MHz or 1-MHz standard) or in digital form (2,048 kbit/s).

For these applications also, the present distribution network would not provide satisfactory performance characteristics in terms of repetition pitch and transmission quality and would require, in most cases, the ad-hoc laying of cables.

The introduction of optical fibers could solve the greater part of the technical problems deriving from the evolution of the subscriber network and would at the same time offer sufficient transmission capacity to meet the further increase in the demand for services.

On the other hand, the current costs of optical cables and components make the use of optical systems in this area of the network impracticable in many cases. Such use would be justified today only in cases in which it is strictly necessary on account of transmission requirements, as could happen for the applications discussed earlier in point III.

This derives largely from the fact that many of the technical solutions presently available for optical fibers, cables and components have been planned and optimized for the interurban and junction networks. It should be kept in mind, however, that more economical solutions can be identified, meeting the less rigorous technical requirements of applications in the distribution network.

In what follows, after brief analysis of the transmission-capacity needs foreseeable in the evolution of the distribution network, the principal characteristics and performance of the optical fibers and the systems suitable for the network in question are discussed.

Finally, several economic considerations for verifying the present possibility of a gradual introduction of optical fibers are developed.

2. Transmission Capacities Necessary in the Evolution of the Distribution Network

The present structure of the subscriber junction system is illustrated in Figure 1. It is divided into three parts: the primary network, between the local exchange and the distribution turning sections (PCCP = Primary Cross Connection Point); the secondary network, between the distribution turning sections and the subscriber boxes (CDP = Customer Distribution Point); and the subscriber loop.

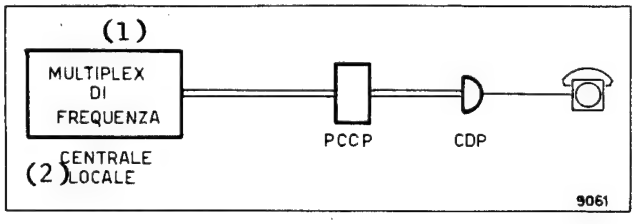

Figure 1. Structure of the existing distribution network

Key:
1. Frequency multiplex
2. Local exchange

The diameters are prevalently 0.4 mm in the primary network and 0.6 mm in the secondary network. In addition to the telephone signal, these junctions currently transmit data in the phonic band, data in the baseband up to 64 kbit/s, line radio (six monophonic channels in the 163-358 kHz band), teletex (12 kHz) and High-Frequency Telephonic Monochannel (MTAF, 28 kHz and 76 kHz).

In future, the transmission systems for the distribution network will have to be able to offer the following capacities (see Figure 2):

A--80 and 144 kbit/s, which are the capacities provided for the multiservice-subscribers' base access to the ISDN [Integrated Service Data Network] and correspond to, respectively, one and two 64-kbit/s channels for digital telephony and for other circuit-switching services, plus a 16-kbit/s channel for signaling, packet-switching services, burglar alarms, etc. The 144-kbit/s capacity represents the best solution for the long term, while for

the medium term, the 80-kbit/s capacity proves the most suitable solution for the limitations of the present subscriber junctions.

B--512 or 704 kbit/s, which are the capacities for the PCM (Pulse Code Modulation) systems at intermediate cipher frequency to be used for the digital PABX's and for connections of low transmission capacity (respectively, 8 or 11 64-kbit/s channels).

C, E--2,048 kbit/s, which corresponds to the capacity of a primary PCM multiplex in the Europe hierarchy; the systems with this capacity should be used in the distribution network both for connections all the way to the subscriber (case C) and for connections between distant multipliers or concentrators and the local exchanges (case E).

D--5 MHz, which is the overall bandwidth for the standard 625-line video signal.

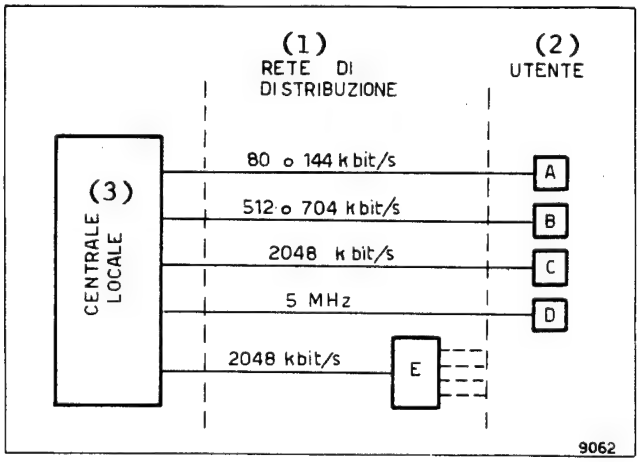

Figure 2. Different types of signals in the future distribution network

Key:
1. Distribution network 2. Subscriber 3. Local exchange

As regards transmission of video signals in the subscriber network, taking the aforementioned capacities into account, it is possible to outline three prospects:

I-- transmission in digital form with reduced image frequency and codification with one or more 64-kbit/s channels (the "videoloento" systems);

II-- transmission in digital form and codification at 2,048 kbit/s, which can be considered the "digital equivalent" of the 1-MHz standard for applications of the videolento or videoconference type;

III--transmission of the standard video signal in analog form, with analog-to-digital conversion at the centralized points of the network and subsequent digital transmission in the interurban network.

(In the present article, monodirectional distribution to the TV-channel users is not taken into consideration.)

The present distribution network is poorly adapted to transmission of the abovementioned cipher frequencies and bandwidths, both on account of the intrinsic transmission capacities of the symmetrical-pair cables and because of the presence of irregularities and disturbances of various kinds. These problems are discussed in detail in Bibliography 2, in which 80-kbit/s digital transmission on the current subscriber junction systems is examined, while in the following section, the principal characteristics and performance of the optical-fiber transmission systems are analyzed.

3. Optical-Fiber Transmission Systems

Optical systems for transmission of digital signals at 80, 144, 512, 704 and 2,048 kbit/s and for transmission of analog signals at 1 and 5 MHz are considered.

3.1. Digital Transmission

For cipher frequencies up to 704 kbit/s, the use of a single fiber for both transmission directions is planned, using the time-division (TD) and wavelength-division multiplexing (WDM) techniques.

In the case of cipher frequency equal to 2,048 kbit/s, both the use of one fiber for each transmission direction and the use of a single fiber and transmission by the WDM technique have been considered.

The aforesaid cipher frequencies correspond to net capacities, and thus the frequencies effectively transmitted (symbol frequencies) have to be increased slightly so as to include a suitable additional service capacity.

Such additional capacity has not been considered in the case of 2,048 kbit/s because it was hypothesized that such a frequency results from a normal raster structure.

Table 1 presents the symbol frequencies adopted (before line codification) for the various net-cipher freuqncies and for the two transmission techniques considered.

Table 1--Symbol Frequencies (kbit/s) for Bidirectional Transmission with the TD and WDM Techniques on a Single Fiber

	Transmission Technique	
Net Cipher Frequency	TD	WDM
80	256	88
144	480	152
512	1,704	576
704	2,344	768

Figure 3 shows permitted fiber attenuation α (dB/km) in function of repetition ptich 1 (km) at the different cipher frequencies.

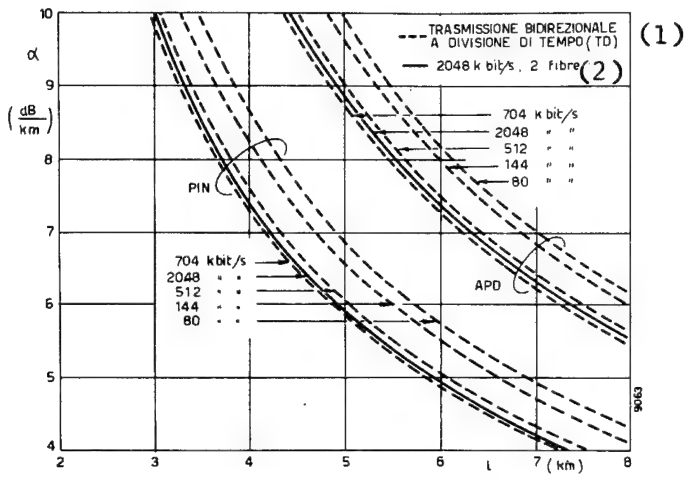

Figure 3. Fiber attenuation α permitted in function of repetition pitch 1, for digital transmission

Key:

1. Time-Division (TD) Bidirectional Transmission 2. Fibers

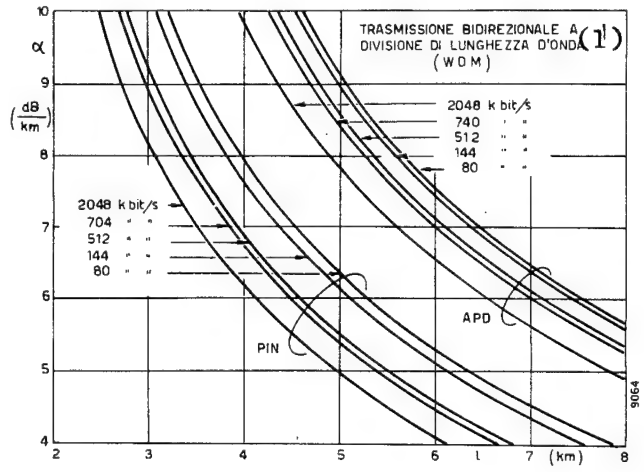

Figure 4. Fiber attenuation α permitted in function of repetition pitch 1 for WDM digital transmission

Key:

1. Wavelength-Division Modulation (WDM) Bidirectional Transmission

The broken-line curves refer to the systems with single fiber and TD transmission technique, and the solid-line curves to the 2,048-kbit/s system with two fibers.

The curves were obtained on the suppositions of a CMI (Code Mark Inversion) line code, a mean coupled power in the fiber equal to -10 dBm, and a sum of the losses in the splices and connectors and the system and installation margins equal to 12 dB.

For use as detector, both a PIN (P-positive, I-intrinsic, N-negative doped-silicon detector) and an APD (Avalanche Photo Diode), with high-impedance conventional preamplifier, were considered.

From Figure 3 it can be deduced that by use of low-quality fibers--for example, α = 7 dB/km--it is possible, at 2,048 kbit/s, to cover distances longer than 4 and 6 km, respectively, with PIN and PAD.

For the 80-kbit/s cipher frequencies and using a single fiber for both transmission directions, these distances become about 5 km and 7 km.

It can be noted that that the influence of the cipher frequency on the repetition pitch is far lower than in transmission with metal cable. This is due both to the fact that these frequencies are very low vis-a-vis the bandwidths of the fiber, even if low-quality fibers are used (for example, 40-50 MHz/km), and to the fact that for cipher frequencies that are so low, the quantum-noise effect on the sensitivity of the receiver increases.

Figure 4 presents the results obtained in the case of bidirectional transmission on a single fiber using the WDM technique. In this case, a further loss of 5 dB has been taken into account, comprising the insertion losses of the optical coupling devices and the effects of diaphony.

3.2. Analog Transmission

Analog transmission of video signals in the distribution network could be preferred to digital transmission since it makes it possible to concentrate the analog-to-digital converters, which are still very expensive, at convenient points in the network.

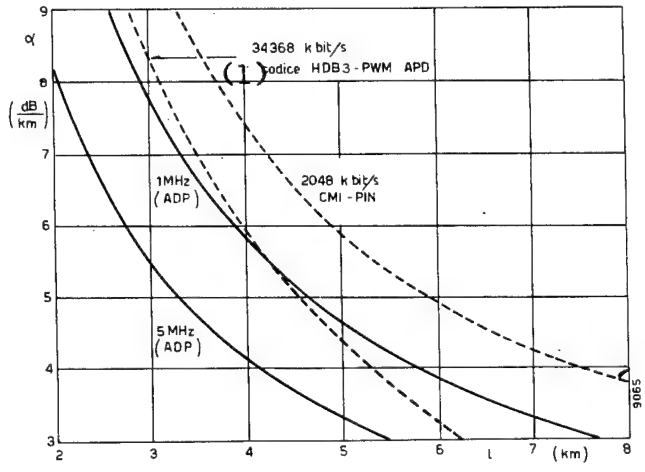

Figure 5. Fiber attenuation α permitted in function of repetition pitch for analog (solid lines) and digital (broken lines) transmission. (PWM = Pulse Width Modulation)

Key:
1. Code

There are many methods for modulating the light emitted by an optical source by means of an analog signal; the most suitable is Direct Intensity Modulation (DIM) of the light. One disadvantage with DIM modulation lies in the nonlinear characteristics of the LED (Light-Emitting Diode), whose effects--expressed, for example, in terms of differential gain and phase--influence transmission quality.

Normally, with the sources available on the market, one can obtain differential gain and phase values that are compatible with good transmission quality only with relatively low modulation indexes.

The continuous curves of Figure 5 illustrate the fiber attenuation α permitted (dB/km) in function of repetition pitch 1 (km) for an APD detector.

In addition to transmission of the 5-MHz band, transmission of the 1-MHz band, which corresponds to the other possible standard for videotelephone and videoconference, was considered also. The differential phase and gain values for transmission of the 5-MHz band prove to be, respectively, 9.4 percent and 5°; the unweighted signal-to-noise ratio is 44.6 dB for both bands, which for the 5-MHz band corresponds to a weighted signal-to-noise ratio of 52 dB; and the total loss in the connectors and splices was assumed to be 6 dB.

In Figure 5 are shown (broken lines) also the fiber attenuations permitted at the cipher frequencies of 34,368 and 2,048 Mbit/s, which can be considered, respectively, the digital equivalent of 5 MHz and 1 MHz.

It can be noted that with appropriate selection of fiber attenuation, it is possible to cover all the distances involved in the distribution network; in any case, with a fiber having attenuation of 7 dB/km, it is possible to cover the major part of the present connections.

Finally, it should be noted that the optical technologies offer a simple way--the WDM method--of combining different signals, analog and digital, in the same fiber.

An interesting application of this technique can be simultaneous videoanalog (for example, 5 MHz) and digital (for example, 80 kbit/s) transmission.

4. Optical Components

Examining the characteristics of the optical sources, fibers and detectors, particular attention has to be devoted to their costs and to the simplicity of the systems, these being essential elements for satisfactory use of the fibers in the subscriber network.

The sources available are the Light-Emitting Diodes (LED's), the Super-Luminescent Diodes (SLD's) and the Laser Diodes (LD's). The LED's seem to be the most appropriate sources in that they fill better than the others the requirements of reliability, cost and simplicity of the control circuits; in addition, they have an adequate emitted power for the frequencies and distances involved.

The light power that can be coupled in a fiber with diameter of 80 μm and numerical aperture (NA) of 0.3 falls between 100 and 150 μW.

The working wavelength should be comprised within the field of 800-900 mm (I window), since the use of longer wavelengths (II or III window) would imply more expensive fibers and components.

As regards the type of fiber, it is possible to use both those of the index-of-refraction step type and those of the graduated-index type; however, the graduated-index fibers offer wider bandwidths, and use of them would therefore make it possible to cope eventually with growing traffic exigencies and increase in demand for services. In such case, adaptation of the network to the altered requirements could be achieved simply by changing the terminal sets at the user end and in the local exchanges.

The choice of the fiber parameters is influenced by many factors. Generally speaking, the smaller the diameter of the core, the lower is the cost of the fiber; on the other hand, smaller cores imply greater losses in the splices, in the connectors and in the LED-fiber coupling. A good compromise between the cost of the fiber and the transmission performance characteristics is a fundamental point in the choice of the fiber to be used.

Taking into account the frequencies to be transmitted (up to 2,048 kbit/s) and the distance to be covered (4 to 5 km), a good choice could consist in fibers having a NA equal to 0.3, a bandwidth of 40 MHz X km, attenuation of 6 to 7 dB/km, and core diameter between 60 and 80 μm.

Naturally, for particular applications that involve longer connections and/or higher cipher frequencies, lower attenuations and wider bands could be required. In this regard, it should be noted that in order to handle the various necessities of the network and of the subscribers, fibers with different transmission characteristics can easily be combined in the same cable.

As regards the optical detector, both avalanche photodiodes (APD's) and PIN photodiodes can be used. The PIN solution is the more economical one inasmuch as it requires simpler circuits, and the corresponding power penalty as compared with the APD can be reduced by careful design of the first state of the reception amplifier (using, for example, an integrated PIN/FET [Field-Effect Transistor] module).

5. Preliminary Cost Considerations

The continual evolution of optical-cable technology makes it difficult to predict the future costs of the optical transmission systems or to make a sound economic comparison with the conventional systems. A preliminary comparison is made here, on the basis of two simple cases:

I-- 2,048-kbit/s transmission system for direct connection of subscribers to the exchange with symmetrical-pairs cable or with optical cable;

II--voice-frequency connection with metal cable for 30 telephone channels or 2,048-kbit/s transmission in optical cable by a multiplier close to the subscribers.

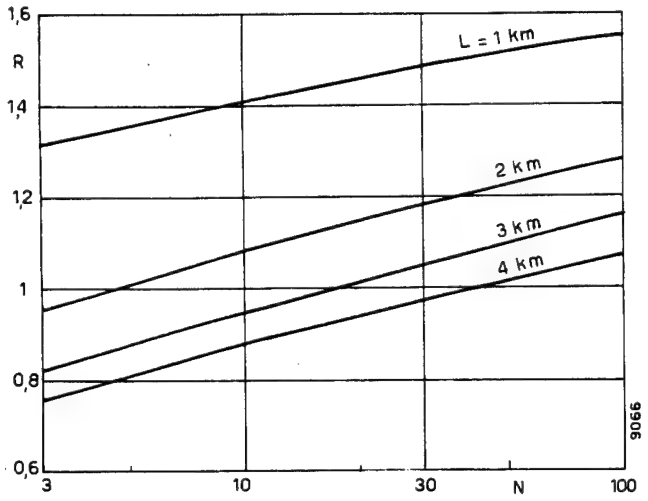

Figure 6. Comparison between 2-Mbit/s transmission in optical cable and in metal cable. R = total-cost ratio between optical system and system with N symmetrical pairs functioning at 2,048 kbit/s; L = length of connection

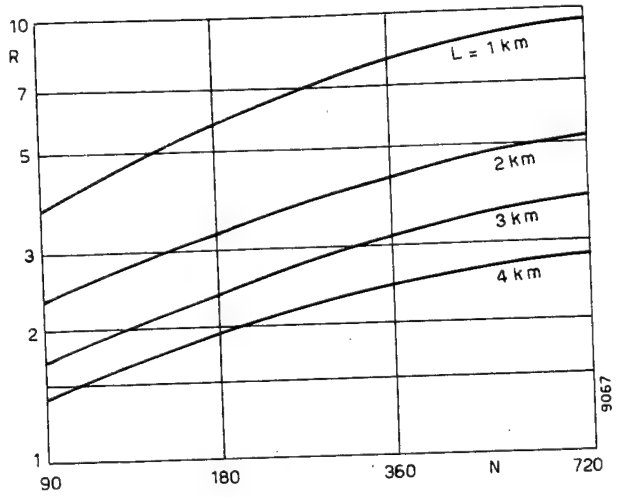

Figure 7. Comparison between 2,048-kbit/s transmission in optical cable and at voice frequencies in metal cable. R = total-cost ratio between 2,048-kbit/s optical system and 30 telephone channels at voice frequency in function of number N of subscribers; L - length of connection.

The costs of optical cables have been arrived at by hypothesizing appropriate reductions from the current ones on the basis of the trends and the experience that has so far developed in Italy. In particular, the cost of fiber was presumed to fall between $0.08 and $0.10 per meter, while a reduction of about 30 percent and 40 percent, respectively, was presumed for installation and cabling of the fiber.

Figure 6 presents the ratio R between the total cost of the optical systems and those of the symmetrical-pairs systems, in function of number N of the 2-Mbit/s systems and for various lengths L of the connection (case I). It can be noted that on the aforesaid hypothesis, transmission by optical fiber proves competitive for a low number of systems and for distances greater than 3 km.

Figure 7 presents the ratio R between the cost of the 2,048-kbit/s system in fiber and the total cost of the 30 telephone channels transmitted at voice frequency in function of the number N of subscribers and for various connection lengths L (case II). From the figure it is deduced that the optical transmission system is not competitive with voice-frequency transmission in pairs, and in the most favorable case, the fiber system proves about 50 to 60-percent more expensive.

From the economic comparisons made for the two simple situations described above, it can be concluded that optical fibers could effectively be used in the distribution network for high-capacity connections, while widespread use of them for telephone applications requires further reduction of costs and an improvement of the technologies.

6. Conclusions

Optical fibers represent an effective means of substantially improving the transmission capacity and the performance characteristics of the distribution network with a view to digitalization of the network and the growth of new services. Typical advantages of fibers are immunity to diaphonies and to external interferences, the small dimensions and lower weight of the cables, permitting more efficient use of the existing infrastructures (conduits, manholes, etc), and the feasibility of connections without intermediate repeaters, which simplifies the operation and maintenance of the installations.

The preliminary economic considerations show that even if the reasons for projecting widespread use of fibers are still not obvious, at least in a medium-term outlook, it is reasonable to foresee several more decisive phases in their introduction into the network, as in the case of connections for wide-band services or for connecting to the network new industrial or commercial areas where it is reasonable to expect a considerable percentage of multiservice users.

BIBLIOGRAPHY

1. Bonaventura, G., Costa, B., Cottatellucci, O., Daino, B., Esposto, F. and Lombardi, F., "COS3/FOSTER Field Trial with an Optical Cable in Rome," Sixth European Conference on Optical Communication, York, September 1980.

2. De Julio, U., Fausone, A. and Pellegrini, G., "Experiments of Digital Transmission in Subscriber Loops," International Conference on Communication, ICC '81, Denver, June 1981.

11267
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INTEGRATION OF SATELLITE SWITCHING SYSTEM WITH GROUND NETWORK

Turin ELETTRONICA E TELECOMUNICAZIONI in Italian May-Jun 82 pp 115-120

[Article by Roberto Preti, Salvatore De Padova and Antonio Puccio*]

[Text] Summary--Integration of a satellite switching system with the ground network. Satellite telecommunications systems are becoming attractive for regional and domestic applications where large economies of scale can be obtained. After a short review of some problems that arise on integration of a satellite system with these networks, it is discussed how large transmission capacity can be obtained by using a spot coverage plan at 20/30 GHz and on-board switching techniques. On-board switching concepts and relevant implementation technologies are presented. A satellite network configuration is proposed such that in the earth stations the buffer memories of TDMA [Time-Division Multiple Access] can provide switching capabilities. The functions of a master station and the problems of pathfinding are dicussed.

1. Introduction

Since 1965, the year of the placing of the Intelsat I telecommunications satellite in orbit, communications via satellite have continued to show a spectacular capacity for development.

The improvements gradually introduced, both in the on-board equipment and in the ground equipment, have brought about a drastic reduction in the cost of the connections. Consequently, the use of satellites for telecommunications, originally limited to international connections, has gradually come to involve the international and national networks.

A confirmation of this trend comes from the fact that an increasingly large number of telecommunications satellites has been developed, or announced, even by countries, such as those of Europe, of limited size and already provided with well-developed ground networks (Bibliography 1).

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* Engineer Roberto Preti and Engineer Salvatore De Padova of the CSELT [Telecommunications Research and STudy Center, Turin); Engineer Antonio Puccio of Telespazio, Rome. Typescript received 22 March 1982. This paper was presented to the International Symposium on Switching (ISS) held in Montreal, Canada, in September 1981.

Use in the national framework may require that the stations work at a network characterized by a high number of relations with small traffic values, on the average, and therefore difficult to achieve by direct connections with any efficiency. It follows from this that the ground stations will have to provide for real switching functions and therefore process the signaling and route the calls in order to combine the traffic adequately.

In such way will it be possible to achieve the network via satellite with high efficiency, but it will also have to be integrated functionally with the ground network.

In what follows, several problems that arise in integration of the two networks will be examined, and several problems deriving from the presence of switching functions both in the ground stations and on board will be presented.

2. Integration with the Ground Network

One of the problems connected with the use of connections via satellite is the one deriving from the long signal-propagation time.

Indeed, the propagation time from subscriber to subscriber is about 300 ms in the case of transit via satellite, and when a double transit cannot be avoided, one jumps to about 600 ms.

The subscriber's sensitivity to the long propagation times and the influence of such times on connection quality have been the subject of study and experimentation since the first connections via satellite, and a large mass of data is available on it, obtained by means of questionnaires and observation of the difficulties present in the course of the conversation.

The data demonstrate that even such long propagation times do not by themselves cause serious difficulties; the subscriber's dissatisfaction derives rather from the echo phenomena and from the distortions introduced by the means for reducing them (suppressors). Especially in the case of double transit, when four echo suppressors may be present (indeed, it is not always possible to disconnect the two intermediate ones), the syllable-truncation phenomena prove rather annoying. However, except for these particular cases, the performance characteristics of the suppressors prove acceptable, at least until the network's evolution in the direction of widespread digitalization produces a considerable improvement in the quality of the channels (in terms of distortion, attenuation, signal-to-noise ratio, etc), and the echo phenomena, no longer masked by other disturbances, will become an element conditioning quality itself.

Considerable progress is expected from the echo cancellers, devices that eliminate the fork return without interrupting the channel backward; it follows from this that it is not necessary to incapacitate them during transmission of data in phonic band and of record signaling.

As regards signaling, it should be noted that while it is natural to expect the common-channel systems to come gradually to the fore (first, ICCTT [Interna-

tional Consultative Committee on Telephony and Telegraphy] No 7)--systems optimized both for telephony and for data--for a number of years, the system used in the European framework will still be of the multifrequency type. The R2 system, though not specified for use via satellite, has been shown to be validly usable (one confirmation has come from the experimentation carried out on the OTS [expansion unknown] and Symphonie satellites), and use of it has been accepted for the European ECS satellite.

A final note on the problems of synchronism. The national digital network is being set up with synchronous structure; in order for the runs via satellite to be able to constitute an integral part of them, they must present an interface free of creeps.

For this purpose, it is necessary to use suitable memories in the ground stations for compensating for the variations in propagation time due to the perfect geostationariness of the satellite's orbit, and it is necessary to hook up the satellite system's clock to the national master clock, thereby obtaining a theoretically synchronous interface.

Finally, it should be noted that in case of networks with plesiochronous structure, the stability of the satellite system's clock (10^{-11}) is such as to guarantee an interface with acceptable frequency creep.

3. On-Board Elaboration

The satellite is a common resource through which all the points on earth that are seen by the satellite itself can be interconnected. It was with this in mind that the first satellites were equipped with an antenna capable of illuminating the entire terrestrial surface seen by it (global-coverage satellites).

This solution, though simple from the technological point of view for the on-board satellites, presents disadvantages and limitations. In this way, indeed, power is also sent from the satellite to those zones of the earth not involved in the use of the satellite, with a resultant waste of power and therefore an increase in the on-board power required. Besides, with global coverage, a given radio carrier can be used a maximum of two times, using transmissions in orthogonal polarizations of the electromagnetic field, thus limiting the overall capacity available for a given radiofrequency band. The time-division multiple-access (TDMA) technique and the use of high frequencies (20/30 GHz) are auxiliary aids to the solution of these problems.

The overcoming of such problems can be achieved by illuminating the territory selectively by means of a set of coverages (spots), each limited to a small area around the ground stations.

Satellites of this type, equipped with multibeam antennas, optimize the use of the on-board power available and make it possible to reuse the same carrier frequency several times in appropriately disconnected spots.

In this way, though, several technical problems arise, in connection with the larger dimensions necessary for the satellite's on-board antennas and the interconnections between stations belonging to different areas.

The different areas have to be put into communication with one another by means of appropriate on-board devices. The most promising technique uses a coupler that periodically puts each access channel in communication with all the others; this is referred to as time-division multiple access with on-board switching (SS/TDMA) (Bibliography 3).

The on-board switching can be done on the radiofrequency signal or, in the case of regenerative satellites, on the baseband signal.

In that case, the signals received on board are demodulated (regenerated) and therefore can be switched with digital devices before remodulating the carrier to be transmitted.

On-board regeneration has several indisputable advantages, such as disconnection between the uplink and downlink transmissions, which permits independent optimization of the two runs, but in particular offers interesting prospects. Indeed, the presence of the signal on board in digital form, and thus already prepared for processing, opens up the possibility of the on-board equipment's carrying out completely new functions (error-correction, speed-conversion [Bibliography 4], packet-switching, etc), introducing new degrees of flexibility into the satellite network.

Evolution in this direction is severely limited at present by the weight and power limits that already make achievement of the simple switching function critical.

Indeed, an on-board switch is being developed with the restriction of not exceeding a few kilograms of weight and a few 10's of watts of absorption, with the whole obvisouly including the redundancies necessary for guaranteeing it a survival probability of at least 95 percent after 7 years of mission.

It is obvious that the technical solutions developed for the networks for connection to the ground network, with these restrictions taken into account, will not be usable in the near future; indeed, considering that the digital flows to be switched come at high speed (120-360 Mbit/s) and are organized in rather long strings (2 ms or more), any form of real-time on-board switching proves impracticable.*

Nevertheless, even by doing only space-division switching on board, which requires far simpler devices, a high degree of flexibility can be achieved by having the memories present in the ground stations cooperate with the on-board switch by means of a procedure that achieves (albeit with interstage connections of 35,000-km length) an articulated switching structure of the time-space-time (TST) type.

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* However, the designing (for experimentation on the ground) of a switch with on-board string memorization (TST structure) is already in progress, as long-term research. The research is being conducted on a collaborative basis by Selenia, ITALTEL and the CSELT, on behalf of the ESA [European Space Agency].

4. Technology of the On-Board Switching System

4.1. Microwave Switching System

With the feasibility of a radiofrequency switching system verified by means of system studies and technological evaluations, development of the first prototype began in 1969 in the laboratories of Comsat. There has been considerable progress since that time, to the point that on-board switching is already planned for the sixth generation of Intelsat satellites (1986).

Comsat presently has a switch with characteristics very close to those required and weighing about 7 kg in the 16 X 16 version; it has absorption of about 5 watts and switching time around 50 ns (Bibliography 5).

The unit, of matrix-control type, is made up of four custom integrated circuits in MOS/LSI [Metal-Oxide-Semiconductor/Large-Scale Integration] technology and is completely duplicated.

4.2. Digital Switching System

The studies aimed at developing a digital switching system are relatively recent. In 1976, the CSELT, among the first, evaluated the feasibility of a switch of this type, identifying the schemes of reference of development of it, and in addition, has for a couple of years been participating in a research program for experimental verification of feasibility.

The specifications for the switching system derive from a system study conducted by Telespazio (Bibliography 3) for evaluating the suitability of a domestic satellite within the European framework.

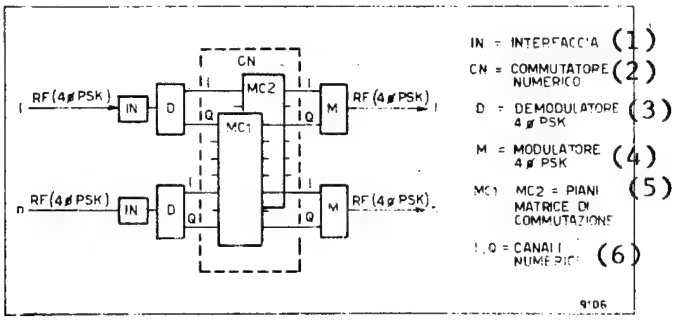

Figure 1. Functional diagram

Key:

1. Interface
2. Digital switch
3. 4ΦPSK demodulator
4. 4ΦPSK modulator
5. Switching-matrix planes
6. Digital channels

Figure 1 presents a functional-block daiagram; it shows the structure composed of two parallel planes for switching the two channels (I, Q) at the output from each demodulator (D) before the input of the modulators (M).

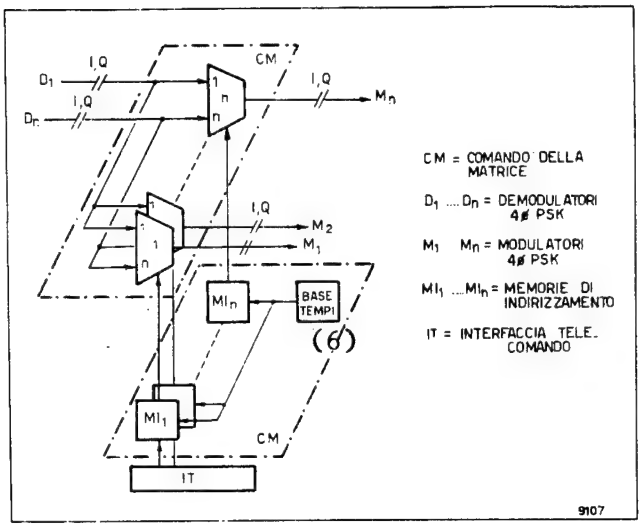

Figure 2. Block diagram of an n·n digital switching system

Key:

1. Matrix control
2. 4ΦPSK demodulators
3. 4ΦPSK modulators
4. Address memories
5. Remote-control interface
6. Time base

Figure 2 presents a more detailed elemental diagram in which the address memories (MI) and the termination of the remote-control channel for writing and monitoring these memories are represented also. The switching system is diagrammed with a set of multiplexers (as many as there are modulators), each capable of switching the two channels; the outputs of the demodulators are multiplied on all the multiplexers.

With suitable programming of the MI memories, it is possible to associate the demodulators with the modulators with any permutation of the connections; in addition, such permutation can be changed numerous times during the string. The sequence of the permutations is repeated identically with each string (but can be changed where a reconfiguration of the connections is required).

The possible structures of a digital switching system are affected by the conditions in which it has to function--in particular, by the fact that the earth-to-satellite propagation time differs from station to station, and in addition, changes in time because of the movement of the satellite.

Therefore the demodulator outputs present signals that are not phase-correlated; in addition, the phase differences are not kept constant in time. Finally, the signals themselves are frequency-modulated by the Doppler effect.

Consequently it would seem advisable to retime the digital flows with the on-board clock before doing any operation (retiming will in fact be necessary when the operations are not limited to switching but it is desired to do actual signal processing on board).

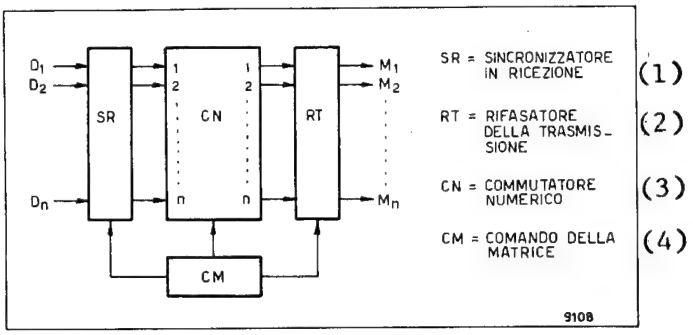

Figure 3. Synchronous-structure switching system

Key:

1. Reception synchronizer
2. Transmission rephaser
3. Digital switch
4. Matrix control

In addition, a second signal-realignment process at the modulator inputs would be advisable in order to compensate for the differences in propagation time within the matrix and for transmitting continuously in the downlink run.

The complexity of the timing circuits could, however, become prevalent over the complexity of the switching system itself, particularly at the higher cipher frequencies (360 Mbit/s, for example); consequently it is not always possible to provide them where the absorption restraints are severe. The structure of the switching system can therefore take on different configurations.

On the basis of the considerations presented above, two structures for the switching matrix can be identified:

--Synchronous structure (Figure 3). The signals are synchronized and aligned at both the input and the output of the switch. This is the more complex structure, but it offers considerable advantages in terms of string efficiency and permits continuous transmission in the downlink run.

--Asynchronous structure. This structure presents itself as completely transparent to the digital flows that it switches, and in the absence of an alignment circuit, has a simple enough structure; however, it reduces string efficiency and introduces distortions into the flow because of the differences in the propagation times within it

5. Influence of an Asynchronous Switching System on the Performance Characteristics of the Connection

In order to evaluate how much an asynchronous (transparent) switching system can influence the performance characteristics of the connection, let us analyze the principal distortions that it introduces:

a) a phase shift t_{off} between the two flows (normal and in quadrature) switched by the two planes of the matrix;

b) a rapid variation (jitter) t_j of the instant at which the signal changes level because of noise and undesired connections inside the switch;

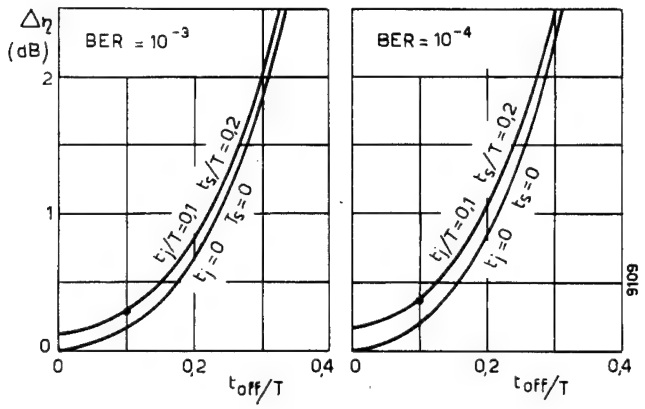

Figure 4. Sensitivity of downlink run to distortions of the modulating waveform.

$\Delta\eta$ = deterioration of signal-to-noise ratio; t_{off}/T = normalized offset time.

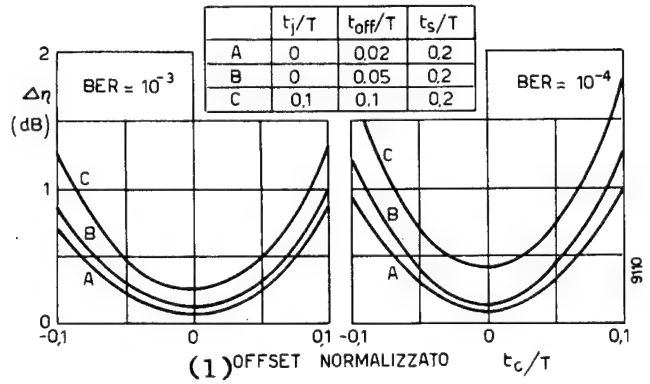

Figure 5. Deterioration of downlink run in function of normalized offset t_c/T at instant of sampling. The curves A and B represent the deterioration in the presence of a realignment circuit at the modulator input. Curve C is calculated in the absence of realignment circuit.

Key:
1. Normalized offset

c) increase in uplink and downlink transmission times because of noninstantaneous response of the logic circuits involved. For practical reasons, an increment t_s for the uplink and downlink times should be defined that also includes any difference between the values of t_{off} and t_j.

In order to evaluate the influence of these factors on the performance characteristics of the connection, and of the downlink run in particular, programs have been developed for calculating the deterioration of the signal-to-noise ratio at the error-rate (BER) threshold values of 10^{-3} and 10^{-4} (Bibliography 6). The results are presented in Figure 4.

Typical values for t_j, t_{off} and t_s are:

$$t_j = 0.5 \text{ ns} \qquad t_j/T = 0.1 \text{ ns}$$
$$t_{off} = 0.5 \text{ ns} \qquad t_{off}/T = 0.1$$
$$t_s = = 1.0 \text{ ns} \qquad t_s/T = 0.2$$

in which 1/T = 180 Mbaud is the symbol speed.

Correspondingly, the deteriorations of the performance characteristics have the values:

0.3 dB at BER = 10^{-3}

0.4 dB at BER = 10^{-4}

Even though these deteriorations may seem limited, it has been determined, by means of computer simulation, that under these conditions, the sensitivity of the ground-station demodulator at the instant of sampling becomes very critical.

Figure 5 shows the deterioration of the signal-to-noise ratio in function of offset at the instant of sampling. It is obvious that a 10-percent variation on either side of the ideal sampling instant is sufficient to influence the result on the downlink run to the extent of ~1 dB at BER = 10^{-3} and ~1.3 dB at BER = 10^{-4}.

To remedy this disadvantage while leaving the switching system transparent, a rephasing circuit can be introduced at the input of the on-board modulator. It has been demonstrated that jitter is made negligible and the phase shift between the channel in phase and the channel in quadrature can be made less than 0.2 ns ($t_{off}/T = 0.04$).

6. Switching in the Ground Stations

On-board switching is required essentially in order to increase a satellite's capacity and to overcome the necessity of global coverage of the ground stations. The problems that it solves and the functions that it performs have nothing in common with switching as it is understood in the ground telecommunications networks.

The term "switching" as applied to the on-board functions is ambiguous and can be misleading, and all the more so in that a satellite network can really perform switching functions only if the ground stations are organized in a suitable manner, independently of the presence of a switching system on board.

An example may serve to clarify the concept. Let us consider a network configuration characterized by a large number of ground stations, each connected to a number of telephone exchanges. Let one of these stations (the master) be capable of assigning, call by call, the satellite channels between any pair of stations by analyzing the signaling and therefore determining the routing.

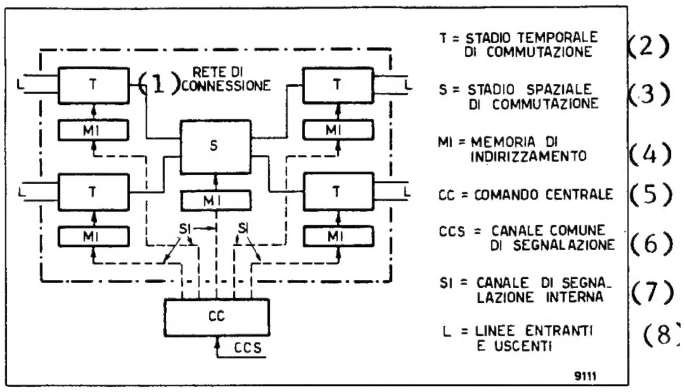

Figure 6. Block diagram of a transit exchange

Key:

1. Connection network
2. Temporal switching stage
3. Spatial switching stage
4. Address memory
5. Central control
6. Common signaling channel
7. Internal signaling channel
8. Input and output lines

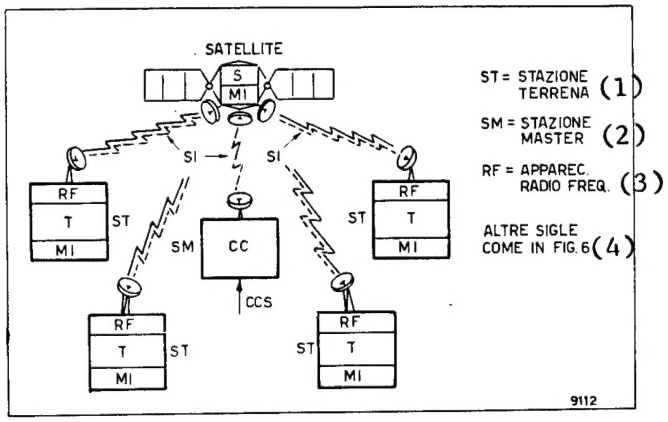

Figure 7. Network via satellite (analogy with Figure 6)

Key:

1. Ground station
2. Master station
3. Radiofrequency apparatus
4. Other abbreviations as for Figure 6

A structure of this kind is very similar to a transit exchange, albeit of new type--that is, disseminated through the complex of ground stations. The analogy can be continued by seeking a correspondence between the subsystems of the two structures.

Figure 6 presents a typical conceptual block diagram of a transit exchange.

One can recognize: the connection network (TST structure); the central control (CC), connected to the signaling network on a common channel (CCS); and the memories for holding the connections, or address memories (MI), which receive

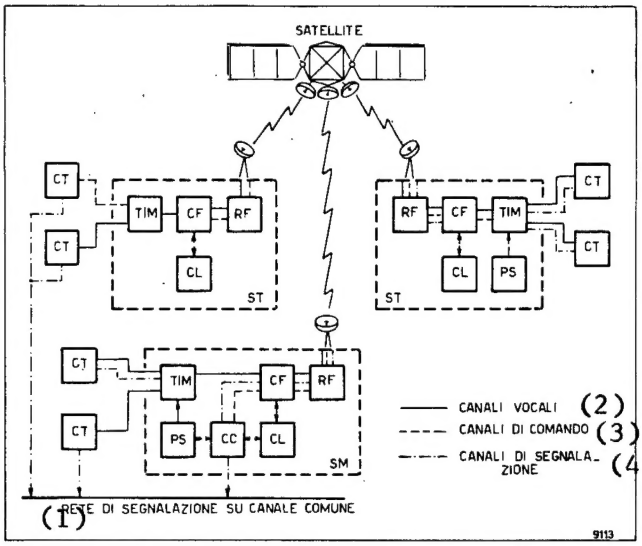

Figure 8. Possible structure of a network with temporal switching (on ground) and spatial switching (in satellite)

Key:

1. Common-channel signaling network
2. Voice channel
3. Control channels
4. Signaling channels

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the commands to be carried out through appropriate internal signaling paths (SI).

The analogy presented is independent of the structure of the connection network; in particular, it can be proposed again for a satellite with TDMA (Time-Division Multiple Access) without on-board switching.

A more detailed diagram is given in Figure 8, which represents another network via satellite that is capable of providing the telephone exchanges (CT) connected to them both point-to-point connections and switched connections.

The master station (SM) performs command functions for the distributed-structure transit exchange, and it is therefore connected to the telephone exchanges (CT) by means of the normal signaling pathways.

If the telephone exchanges are of new technology, the connection is achieved through the common-channel signaling network, whose master station will be connected by modalities identical to those provided for the other exchanges.

If the telephone exchanges are of traditional technology, with signaling associated with the circuit, the ground station to which they are connected will have to provide initial processing of the signaling (PS) at the level of interface with the ground network (TIM).

The interface with the ground network already performs numerous adaptation functions (analog-to-digital conversion, echo control, synchronization), to which have therefore been added the preprocessing of the signaling and conver-

sion of it into the form of messages for efficient conversation with the master station.

Once the signaling received is processed, the master-station (CC) control will transmit the information relative to the connections to be made to the local peripheral control equipment (CL) at the other stations.

In the ground stations, a switching element (CF), possibly integrated in the TDMA terminal, effects the association between the channel entering (or exiting) from the ground network and the satellite channel selected by the central control. The choice of this channel--a real search for a route within the satellite network--is conditioned by the fact that the internal connections have to be used with the highest efficiency possible.

An assignment-on-demand procedure can provide for this. In the TDMA environment, these procedures are made complex by the problems of synchronism, and in particular, in the case of on-board switching, are still under study.

Schematically, three principal cases can be cited, defined as:

--Fixed origin and variable destination.

The stations transmit bursts of constant length; the synchronism conditions of SS/TDMA access itself are not altered, but within the burst, the channels do not have a predetermined destination. Obviously, the destination can vary only between stations that receive from the same transponder--which amounts to saying that each station is connected by means of a single beam with the stations that converge in the same TDMA.

--Origin and destination variable.

To the performance characteristics of the preceding case is added the capacity on the part of the station to vary the length of its own burst, obviously to the detriment (or advantage) of the other stations that access the same transponder in TDMA. This technique makes it possible to consider each pair of transponders connected by a single beam, no matter what the number of stations that access it.

--Complete variability.

This permits a further possibility as compared with the preceding case--that is, varying, by altering the on-board switching plane, the number of circuits used for relations between pairs of transponders. This makes it possible to consider that the traffic generated by the stations of a transponder is offered to a single beam through the remaining stations.

The three assignment-on-demand techniques offer increasing efficiency at the price of increasing complexity in the equipment on the ground and on board. The advisability of adopting one technique or another has to be evaluated case by case by a balancing between cost and performance characteristics to be achieved in function of the configuration of the network and of its parameters (number of stations, number of transponders, overall capacity of satellite, distribution of traffic elements, etc).

7. Conclusions

The technical and technological progress in the area of communications via satellite are moving their field of application from intercontinental to regional communications, and therefore into the national framework; more and more integration with the ground network is thus being required of the satellite networks, to the point that they may even be required to perform switching functions within themselves.

A fundamental ingredient of this evolution is constituted by the high frequencies (20/30 GHz) that make it possible to achieve high-capacity multibeam systems using on-board switching elements for interconnection of the transponders.

Acknowledgement

The authors are particularly grateful to Engineer Amadesi, who consented to publication of the results reported in section 5.

BIBLIOGRAPHY

1. Berretta, G. and Tirro, S., "New Telecommunication Systems at 20/30 GHz," ICC 1980.

2. "Analysis of a 30/20 GHz Communication System via Satellite"--final report of ESA contract No 3609.

3. Trro, S., "Possibilities Offered by Digital Satellite Communications for National Communications in a European Country," Fifth International Congress on Digital Communications via Satellite, Genoa 1981.

4. Pattini, F., "Efficiency of an SS-TDMA System with On-Board Bit-Rate Conversion," ICC 1980.

5. Perillan, L. and Rowbotham, T.R., "Intelsat VI, SS-TDMA System Definition and Technology Development," Fifth International Congress on Digital Communications via Satellite," Genoa 1981.

6. Alaria, G.B., Amadesi, P., Garett, E. and Pattini, F., "System Definition of an On-Board SS-TDMA Baseband Equipment," CSELT Internal Report (work done under ESA contract).

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